ELECTRICAL REVIEW

April 27, 1945

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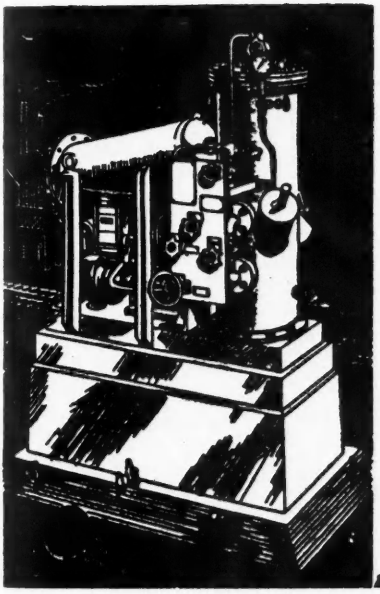

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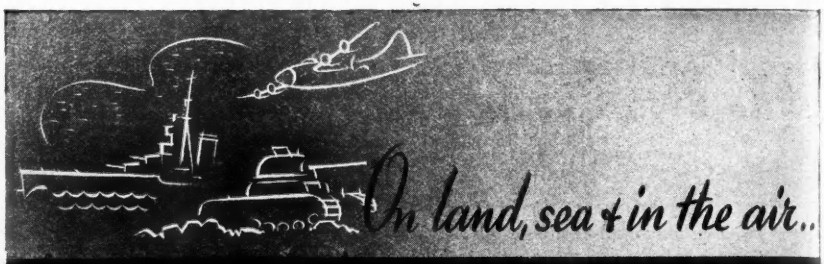

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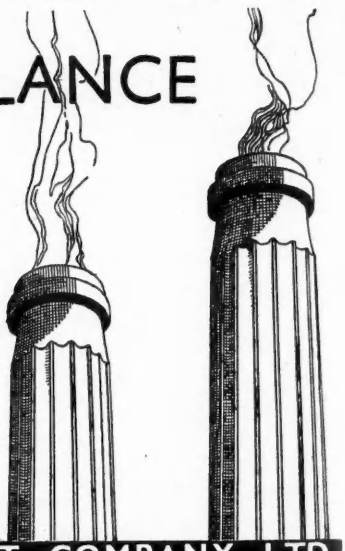

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXVI. No. 3518. APRIL 27, 1945 9d. WEEKLY

Export Trade Recovery

Urgent Need for Market Studies

THE fact that this country will have to increase its exports if anything like a decent standard of life is to be maintained has been stressed *ad nauseam*. What is actually being done to prepare the way for the expansion which is considered so essential?

At present the matter is almost entirely in the hands of the Government which exercises strict control over materials, labour and exports themselves. Until manufacturers can gain definite ideas of the Government's intentions they will not find it easy to shape their policies. But the Government is bound to point out that the war is not yet over and, until it is, the bulk of our resources must be directed towards defeating our enemies who, although some people are inclined to forget it, include Japan. It is possible, however, that after the end of the European war there will be a substantial diversion of materials and manpower to " civilian " production and as the end is near we should be better prepared for this long hoped-for change-over than we seem to be.

Facilitating Travel

As regards export trade in particular it is necessary to re-establish broken connections and form new ones. This means that the way must be made easier for representatives of British manufacturers to travel to overseas countries and that they should be given assistance by Government representatives in *these* countries. Handbooks of the type now being produced by the Department of Overseas Trade are very useful primers but they do not answer all the questions which trade travellers are likely to ask.

It is not to be expected that Government offices will have that detailed knowledge of specific branches of trade which is the only way of obtaining tangible business and indeed there should not be too much reliance upon Government aid. This is where, in default of having their own local men already fully acquainted with needs and possibilities, British manufacturers may look towards such a body as the new British Export Trade Research Organisation. The B.E.T.R.O. plans are ambitious and will take some time to get working. There are so many markets and such a variety of exports that no organisation starting with an almost blank canvas can expect to become effective in less than a year or so.

Finding the Funds

Finance is the primary requirement and B.E.T.R.O. has to convince potential members that they will receive value for their subscriptions. The principal sponsors are concerns well able to run their own market research and yet for the general good they have put up funds and thus have set a worthy example to the less-prominent undertakings who should be the chief beneficiaries. It is proposed that field investigators shall be available to provide specialised reports at reasonable fees and this should prove the next best thing to on-the-spot studies by firms' own representatives, which smaller concerns may not be able to afford.

Speed is essential. The recovery period after the war will provide a little time for

preliminary market research but action cannot be delayed if we are to secure a footing in countries which will try to meet their own needs if we cannot, or will look to our competitors, either of which alternatives may work permanent harm to industry and employment in this country.

I.E.E. By-Laws

Of the several amendments to the by-laws of the Institution of Electrical Engineers that have been accepted by the membership and approved by the Privy Council, most attention will no doubt be paid to the one making the Council responsible for the bestowal of membership, which would be in line with the procedure in other technical societies. This means the discontinuance of the present formal ballot by which candidates, whose qualifications have already been approved by the Council, are passed by those members who happen to be present at the meeting in London when the list is presented. Instead, the names of entrants so approved will be sent with the *Journal* to the whole membership, who will thus have an opportunity of communicating their views to the Institution.

Student Engineers

More important in its practical consequences is probably the defining of the Council's powers to defer beyond twenty-eight years the age at which a student must secure promotion to a higher grade if he is to retain his membership. The greater flexibility thus permitted should keep within the Institution a number of suitable young electrical engineers whom circumstances have prevented from either passing the A.M.I.E.E. examination which would have made them graduates or, failing that, acquiring the full experience in a responsible position requisite to become associates. This is of especial moment now when the careers of so many junior engineers have been interrupted by military service.

Big Cable Combination

Periodical rumours of an amalgamation of important cable making concerns which have been heard during the last year or two have proved to have had solid foundation; the companies concerned are B.I. Cables and Callender's whose stockholders have been given preliminary details of the proposals. These two companies are to be voluntarily wound up and acquired by a new company. The merger is stated to be the outcome of experience gained in co-operative working in scientific improvement of their products and in methods of manufacture, and the combination is expected to be of value in maintaining future trade (particularly export trade) and in stabilising employment. It is evident that the market thinks that the amalgamation will be beneficial to shareholders; the ordinary stocks of both companies rose in value when the proposals became known. A point of interest in this matter is that B.I. Cables have a substantial holding in the Automatic Telephone & Electric Co.

Valuation

One aspect of this merger is the stress it lays on the inability of the outsider to assess the real value of industrial undertakings. The amount of issued capital rarely corresponds with the actual value and balance sheets are not usually accurate guides. Nor can the Stock Exchange quotations be accepted, for they are influenced by many and diverse factors. In the present case the two companies, with a total capital of £4,923, 916 (together with a comparatively small amount representing part of the assets of Callender's Trust), are to be replaced by a new company with a capital of £11,219,175 considered as fully paid. The new company's ordinary capital will amount to £9,240,386 of which Callender's Trust will be allotted £205,812; that of the acquired companies is £3,123,916. At the prices given in the table on another page of this issue, the Stock Exchange valuation of the two companies' ordinary stocks amounts to £19,024,475.

Scientific Curiosity

Few examples of the possible material value of research undertaken in a spirit of scientific inquiry without utilitarian aims are so remarkable as that furnished by the invention of the thermionic valve. The late Sir Ambrose Fleming, an account of whose career is given in this issue, could not have foreseen the consequences to wireless telephony and broadcasting that would result from his investigation of the cause of the "Edison effect," which was observed in an unaccounted for phenomenon that attended the blackening of primitive carbon-filament lamp bulbs.

Mixed Supply Scheme

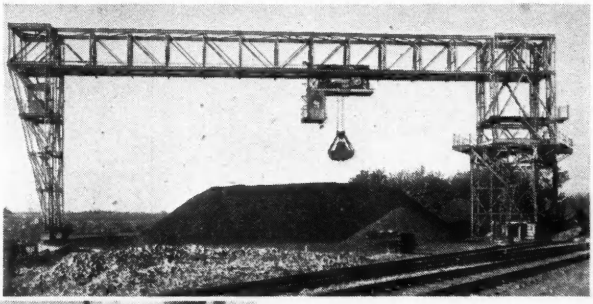
Parallel Running Assists Process-Steam Generation

OUR subject here is the running of two small private generating stations in parallel with the public supply in order to obtain the most economical results in connection with the supply of large quantities of process steam in a very large factory. In drawing up a scheme for the factory electricity supply, the electrical engineers had to try to satisfy two main conditions: (1) that power should be obtained from the grid because of the uneconomical operation of small condensing stations; and (2) that there should be two separate public supplies to ensure continuity.

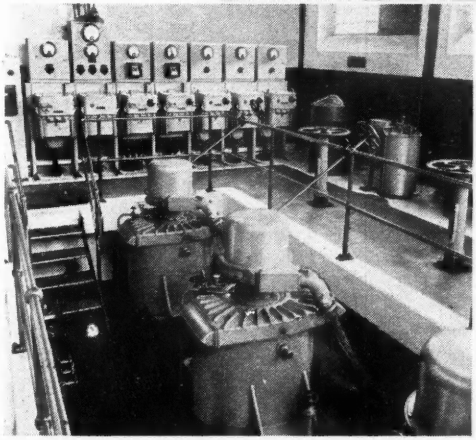
On account of the large factory demand for low-pressure steam for process purposes, however, it was later agreed that pass-out back-pressure turbines should be installed since roughly one half of the power requirements could be obtained economically in this way. The factory requires for process purposes steam at both 100 lb. per sq. in. and 15 lb. per sq. in., and to obtain these pressures steam is generated at 250 lb. per sq. in. and passed through turbines in which part of it is extracted at 100 lb. per sq. in., while the remainder is exhausted at the lower pressure. As none of the steam is condensed it is all available for the factory processes, and the quantity generated is governed entirely by the factory steam demand. Electricity generation in this way is not sufficient to meet the whole electrical demand of the factory and the balance is provided by supplies taken in bulk from the grid.

The scheme outlined above led to the establishment of two factory power stations about a mile apart and two bulk-supply substations as the four electricity supply sources for the whole factory. The output from each source is at 6·6 kV, the main distribution voltage adopted for the factory, and all four sources are connected to a primary 6·6-kV distribution ring main to which are also connected a large number of distribution substations. The power stations generate at 6·6 kV and feed directly into the ring, while the bulk-supply substations receive power from the grid at 33 kV and transform it down to the generation and main distribution voltage.

Under certain conditions when the factory's electrical demand is less than the amount generated in the power stations, as dictated by the process steam demand, the excess is exported to the grid through the bulk-supply substations. The factory, which is employed



The coal-dumping ground is served by a travelling (swivelling) telpher crane which operates over a semi-circular area



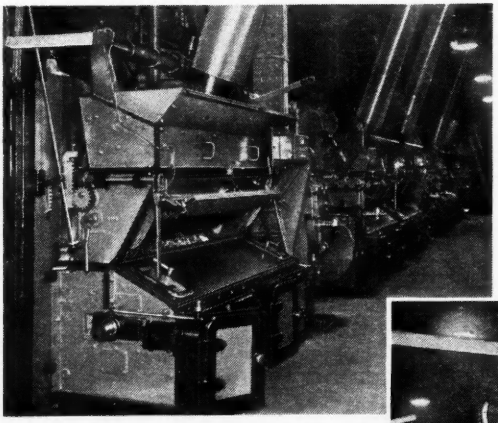
The water supply is of special significance; it is obtained from a pumping station about four miles from the factory

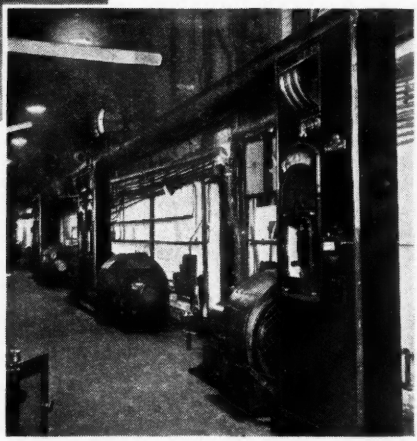
in the manufacture of explosives, is spread over a very large area with the various buildings well spaced for safety reasons, and this feature is reflected throughout in the layout of the electrical distribution.

Unlike the practice for normal electricity generation for which condensing plant is employed and the bulk of the boiler feed water is condensed water, *i.e.*, softened water, in this case all the water is evaporated, so that new feed water is provided all the time. Thus the water supply is of special significance in the electricity supply scheme and provision has been made for the continual softening of the water. The water is obtained from a pumping station, about four miles from the factory, which is equipped with three 360-HP motor-driven Mather & Platt pumps. For the electricity supply to this pumping station there is a substation served by duplicate 11-kV incoming feeders which are connected to Ellison oil circuit-breakers which feed two 750-kVA, 11-kV/400-V three-phase transformers. The output from the transformers is passed to 400-V Ferguson Pailin oil-immersed circuit-breakers which directly serve the pump motors. As a stand-by to the normal supply there is a Davey Paxman 400-kVA Diesel generator set. Water is pumped to two large high-level reservoirs which afford a gravity flow to all parts of the factory.

Before making detailed references to the boiler houses and generating stations it is well to make it clear that the boiler houses are not merely parts of the power stations as is normally the case, and that the generating stations are in the nature of auxiliaries to the major factory boiler plants. Raw water enters each boiler house where it is first metered and is then taken to Permutit water-softening plant in which it is heated to 210 deg. F. by the injection of steam at about 5 lb. per sq. in. This injection also assists in the de-aeration of the water, which is also dosed with lime-soda injections while it is still in the softening plant. There is also a base-exchange stand-by water softener. The water is next taken to two 50,000-lb. per hr. Weir steam-driven feed pumps which serve all five of the Babcock & Wilcox 16,000-lb. per hr. normal evaporation water-tube boilers. The boiler steam conditions are 250 lb. per sq. in. and 650 deg. F., and the feed-water entry temperature is 210 deg. F. Each boiler is equipped with an integral superheater with a heating area of 1,362 sq. ft. and a Green economiser with a heating area of 1,908 sq. ft.

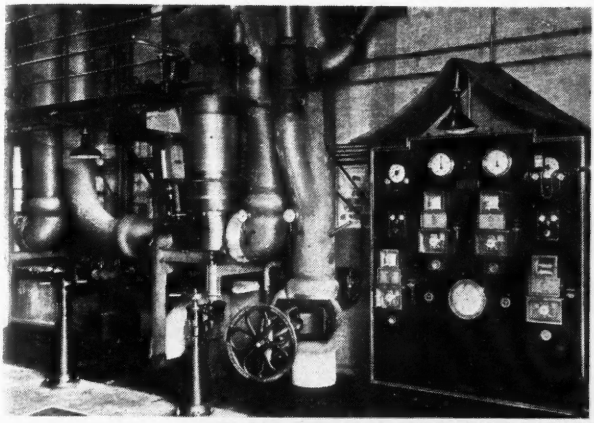
In the generating station the main steam trunking is divided into four branches. Two of these branches deliver steam directly to the two turbines and the other two branches to the two de-superheaters, in one case through a 250/100-lb. per sq. in. reducing valve, and in the other case through a 250/75-lb. per sq. in. reducing valve. Steam from the de-superheater fed at 100 lb. per sq. in. passes to the factory main which is fed at the same pressure from the turbine extraction points, while that from the other de-superheater passes through a 75/15-lb. per sq. in. reducing valve to another factory





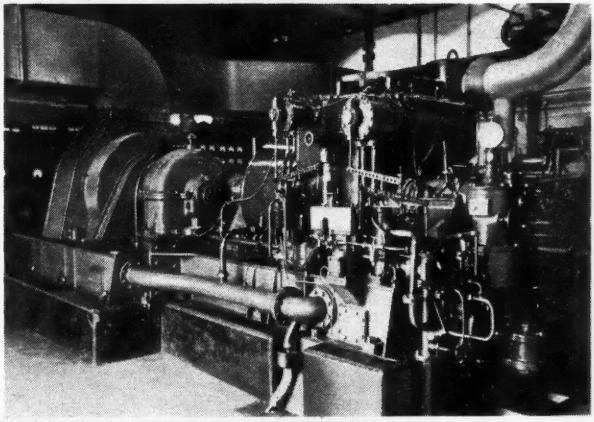
Above: The boiler houses are not merely parts of the power stations as is normally the case; five 16,000-lb. per hr. units
Right: There is one f.d. fan to each boiler; three fans are shown, all at firing-floor level

main which is also fed at the same pressure from the turbine exhaust. Part of the steam passes through the de-superheater



One branch from the main steam range feeds two de-superheaters; steam regulating board on right

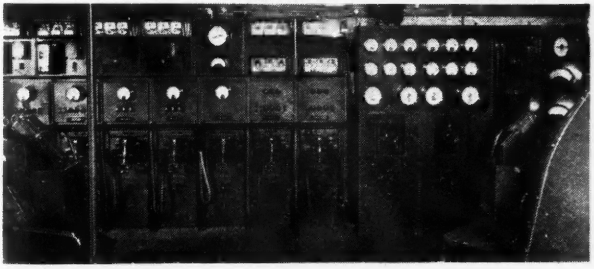
tubes and part outside, and by means of suitable flap valves the proportions of the steam passing each way can be varied to



The two 880-kW turbo-alternator sets generate at 6·6 kV, the factory main distribution voltage

result in any mixture and thus any temperature within the prescribed limits.

Cooling water from the de-superheaters is passed back to the

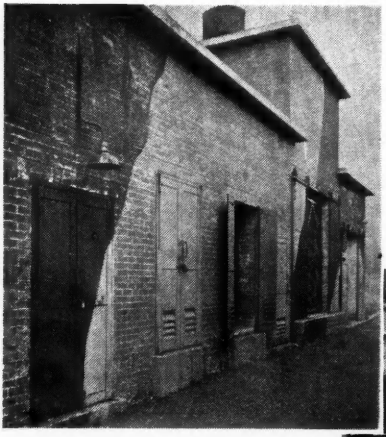


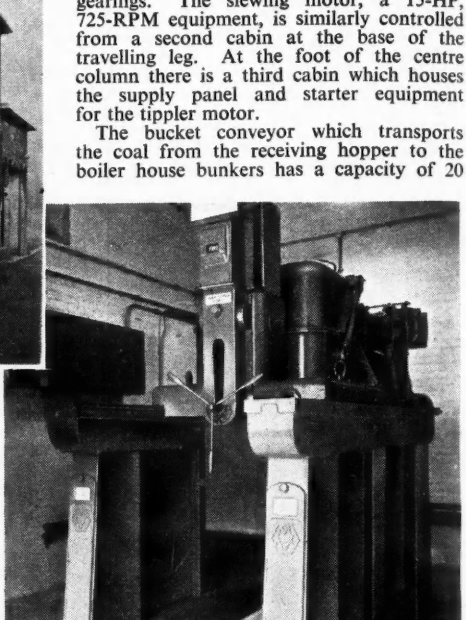
The power house 6·6-kV switchgear and control board (right) are located in the turbine room

boiler feeds. The higher-pressure de-superheater will deliver 29,000 lb. of steam per hr., while the 75-lb. per sq. in. equipment is designed for an output of 22,000 lb. per hr. The two B.T.H. six-stage extraction back-pressure turbines run at 6,000 RPM, and each transmits through a Wellman Bibby flexible coupling to a 4 to 1 ratio double-helical single-reduction gearing directly coupled to the alternator. Each turbine passes out 28,000 lb. of steam per hr. and exhausts 14,000 lb. per hr. at an electrical load of 880 kW. With a loading of 443 kW the pass-out and exhaust figures are 14,000 and 10,500 lb. per hr. Each turbine is fitted with an emergency governor which is arranged to shut off automatically the main steam supply at an over-speed of 6,600 RPM.

The boilers are coal-fired and coal is received in railway wagons at a storage site near each boiler house where it is tipped into

ground-level hoppers by means of a wagon tippler driven by a 25-HP, 725-RPM s.c. motor which transmits through reduction gear to the tippler mechanism. From the hoppers the coal passes to either an under-





Each bulk-supply substation has separate compartments for, *inter alia*, the 33-kV switch (right) and the 6·6-kV switchgear (below); metering is effected at 6·6 kV

ground conveyor serving the boiler house bunkers or to the storage dumps. The dumping ground is served by a travelling (swivelling) telpher crane which operates over a semi-circular area. A grab on this telpher removes coal from the hopper to any part of the dump area. This hoist motion is driven by a two-speed 12½/25-HP, 360/720-RPM s.r. motor with worm transmission, and is controlled from a cabin on the travelling gantry by a reversing air-break switch and drum controller.

The traverse motor, which is also controlled similarly from the gantry cabin, is a 20-HP, 725-RPM equipment and transmits *via* worm gearings. The slewing motor, a 15-HP, 725-RPM equipment, is similarly controlled from a second cabin at the base of the travelling leg. At the foot of the centre column there is a third cabin which houses the supply panel and starter equipment for the tippler motor.

The bucket conveyor which transports the coal from the receiving hopper to the boiler house bunkers has a capacity of 20

tons per hr. and a speed of 48 ft. per min. It is driven by a 10-HP s.r. motor in the boiler house at the top of its vertical portion. Its starter is near the motor, but there are emergency stop-buttons along the line of travel.

Each boiler is served by a chain-grate stoker with an area of 105 sq. ft. This is driven by 1½-HP, 940-RPM motor *via* a four-speed reducing gear which affords a range of stoker speeds from 13·1 ft. per hr. to 43·25 ft. per hr.

Combustion is aided by induced and forced draught, there being two i.d. fans common to the five boilers and one f.d. fan to each boiler. Each Howden turbo-vane i.d. fan is belt-driven by a two-speed 122/20-HP, 735/365-RPM motor and has a capacity of 88,000 cu. ft. per min. Each Howden single-inlet f.d. fan delivers 9,600 cu. ft. per min., and is directly driven by a 10-HP motor.

Each of the alternators is a 1,500-RPM salient-pole machine which is ventilated by means of a fan on the generator shaft, which draws air from a duct under the floor and passes it through the machine to the roof level. Circulating current and over-current protection are provided for the alternator. The 6·6-kV and 400-V switchgear are located in the turbine room at the alternator end, while the 6·6-kV/400-V transformers are housed in an annexe. The 6·6-kV switchgear is directly connected by in and out loops to the factory primary distribution ring main.

Bulk Supply Arrangements

The bulk supply substations, which also serve this ring main, are divided into separate compartments for the 33-kV incoming switch, the 33/6·6-kV transformer, the 6·6-kV switchgear, the 400-V switchgear and the CO_2 fire extinguishing equipment, respectively. The 33-kV switch is a Metropolitan - Vickers spring - operated ironclad compound-filled single busbar oil circuit-breaker with carrying and rupturing capacities of 400 A and 500 MVA, respectively. It feeds two 2,000-kVA, 33/6·6-kV Ferranti transformers which are connected in parallel and operate as one unit. The neutral point on the 6·6-kV side is brought out and can be earthed at will through a resistance and a circuit-breaker housed in the 6·6-kV compartment. The 6·6-kV switchgear is Ferguson Pailin equipment with 400-A and 150-MVA carrying and rupturing capacities.

The two 33-kV incoming feeders, one to each bulk supply substation, are coupled outside the factory by a busbar section switch which completes a ring main from which the substations are fed on either side of the section switch. This arrangement allows both feeders to be in use at the same time as a normal procedure and prevents the ring main being completed through the factory 6·6-kV system. Without this link-up only one of the feeders could be safely used at any one time. It also allows a faulty section to be automatically isolated with the healthy section remaining in service. So that the bulk supply substations may be tripped by the relays at the supply authorities' substation, pilot cables connect the factory and supply substations. A 24-V supply operates a relay and flag indicator which, in turn, energises a relay for tripping the 33-kV and 6·6-kV switches. Distance (impedance)/time relays are provided for distance/time discrimination, and they will trip the associated circuit-breakers on earth and/or phase faults. An under-frequency and an out-of-voltage balance relay are installed at the supply substation to cater for the special conditions which may arise when the factory is fed on one feeder only. If, in this case, there were a fault on the 33-kV line the circuit-breaker would trip by the operation of the appropriate relays, but the generator at the factory would probably continue to supply the fault. This might be a phase-fault or it might clear itself, so that the factory generators would become seriously overloaded by taking load from outside the factory. With the consequent drop in frequency the under-frequency relay would trip both the 33-kV transformer switches, leaving the generators to deal with the factory load.

Isolation of the bulk supply substations from the grid can also be effected manually. The push-button circuit for this is supplied from a 50-V emergency battery in one of the generating stations and is completed by the tripping gear of the bulk-supply substations. There are indicating lights for the operation of the 33-kV switchgear in each generating station. Each section of the 6·6-kV ring between any one substation and its neighbour is protected against phase and earth faults by the "Translay" system, and this protection is supplemented by back-up relays.

Quality Control

UNDER the title "Quality Through Statistics," Mr. A. S. Wharton has produced a 60-page book explaining the problems and methods of quality control in a manner readily understandable by those having only an elementary knowledge of statistics. Mr. Wharton is well qualified for his task by virtue of his experience in setting up and operating the system in a group of factories and also, as our readers will be aware from his articles on the subject in the *Electrical Review*, by an aptitude for clear exposition. The book is divided into three parts, dealing with inspection matters, with probability and statistical limits and with analysis and correlation and it contains sixteen tables, charts and graphs.

The author has obviously kept well in mind the difficulty in many cases of getting quality control schemes adopted on account of their (apparent) complexity and mathematical basis and so he concentrates on the more practical aspects. The value of the intelligent co-operation of factory workers in introducing quality control can hardly be over-emphasised, and it can be shown to be in their own interests. From a wider angle, quality control will be of great importance, as the author states, in enabling this country to meet world competition, since it is essential that the high reputation of British goods shall be maintained in association with mass-production methods.

The book is published (at 6s. post free) by Philips Lamps, Ltd.

Views on the News

Reflections on Current Topics

IN the course of a conversation with Mr. A. E. Rayment (Chas. Begg & Co.), who has returned to this country after seventeen years in New Zealand, I was told that New Zealanders are still anxious to trade with the Mother Country—but not at any price. Generally the superiority of British products is recognised, but New Zealanders will not pay much higher prices for them if equipment is available from Dominion factories which, if not quite so good, will do what they want done at less cost. This is an old story and one which places British manufacturers in a dilemma: they are often told that only superior quality and finish will sell their goods in competition with other countries and then they are faced with a demand for something less handsome and substantial. I suppose that the decision which line should be taken depends largely upon the particular class or kind of equipment in question.

* * *

A few months ago one of the daily papers reported the invention by a Russian engineer of a revolutionary traction system in which underground cables, presumably by a somewhat extraordinary inductive linkage, passed energy to the motors of vehicles passing over them. The paper suggested that the news of this development had given the London Passenger Transport Board something to think about. Experiments with the system were stated to have been made in Cleveland, Ohio, but inquiries by *Modern Transport* have failed to discover anything about either the system or its inventor. But last week I got hold of a copy of the *Soviet War News* in which the same idea is put forward in a rather different guise. This time it is only claimed that the method is employed in connection with small runabouts in factories and so London trams and trolley-buses may still have a certain lease of life.

* * *

Ever since the black-out was modified to a dim-out there has been a general feeling that the Minister of Home Security might have gone the whole hog and decreed a total lifting of the ban. After all even the lesser lights allowed were sufficient to reveal the presence of a town from many miles away. But let us now be thankful for the alleviation of one of the worst of the war's minor evils and hope that the fuel situation will not militate against the resumption of full street lighting as soon as possible after the "appointed day"—July 15th.

Mr. H. O. Davies, secretary of the Association of Public Lighting Engineers, has pointed out that double summer time gives lighting authorities an excellent opportunity to get their equipment into working order. The demand for new equipment is naturally very heavy and manufacturers will have their work cut out to meet it but they are all doing their best.

* * *

The discussion on Mr. H. W. Grimmitt's paper at the Farmers' Club last week showed the need for the kind of information he gave if criticism is to be constructive because well informed. It seemed to me that many among his audience were quite unaware of the advanced state of rural electrification in this country, both as to availability and price, compared with conditions abroad. It is unfortunate that the enthusiasm shown by farmers for electrification consequent upon their improved financial circumstances has come at a time when wartime restrictions have prevented supply undertakings from completing their schemes or the researches which they have initiated into agricultural electrical applications.

* * *

The Ministry of Fuel's efforts to keep pace with the weather are rather pathetic. April, that fickle month, suddenly presents us with summer temperatures, which spurs the Ministry's officials to action regarding central heating systems. Hardly is the ink dry on the order or direction when down goes the mercury and upsets the whole arrangement. Then comes a relaxation of the ban and the thermometer immediately resumes its upward movement. Has it ever occurred to Whitehall that even after five or six years of regimentation the people still retain some sense of proportion and responsibility? Why not rely a little more on sweet reasonableness and stop trying to trace temperature curves with rules and orders?

* * *

Illustrations by "Fougasse" appear in a little booklet "Making Work Lighter" which has reached me from the Illuminating Engineering Society. This is Lighting Reconstruction Pamphlet No. 6 and it aims at showing that correct lighting in factories is not only necessary to the well-being of the employees but may be more than paid for by improved results. Both physical and psychological aspects are dealt with and a great part of the booklet is devoted to the subject of natural lighting. The pictures illustrate the rights and wrongs of factory lighting in an amusing way and thus add to the brightness of the subject.—**REFLECTOR.**

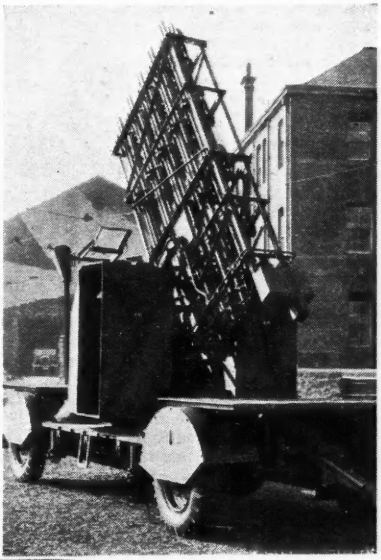
Manufacturers' War Work—I

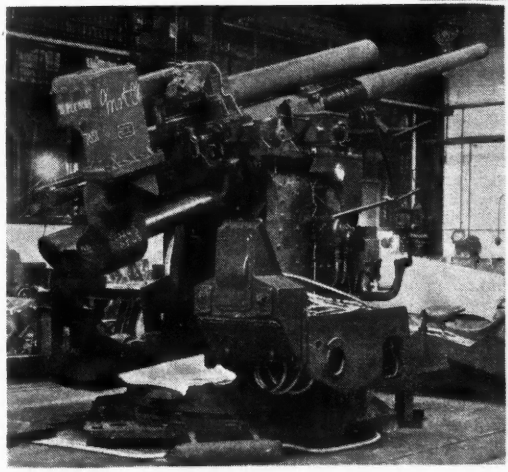
Important Contribution of the Electrical Industry

So much electrical apparatus is required in modern warfare that one might well be excused for thinking that electrical manufacturers would have been fully engaged during the war in making their normal or closely allied products. There has, of course, been a tremendous expansion of production of electrical equipment but, as this and subsequent articles will show, this is only half the story. The versatility and adaptability of British electrical manufacturers has enabled them to contribute to almost every phase of the war effort.

Bruce Peebles & Co., Ltd.

WHEN war became imminent early in 1939, the workshops of Bruce Peebles & Co., Ltd., were launched on a programme of arms production covering large and medium-sized searchlights, parts for 3·7-in. and 4·5-in. anti-aircraft guns, and Bofors quick-firing guns, armoured hull noses and other tank parts, emergency mobile electric power equipments for use in the event of air raid damage to the country's power supply, etc. Later in the year the works were completely switched over to war production. The success achieved in the original pre-war contracts resulted in immediate additional orders for large numbers of powerful mobile searchlights fully equipped with operating gear for control from the predictors on anti-aircraft batteries, and for component parts of anti-aircraft guns and tanks, including thousands of oil pumps for the hydraulic control system on the power-operated gun turrets of tanks. Most of the 2,000 parts in each of these pumps were held within gauge limits of 0·0001 in. and the fact that in the





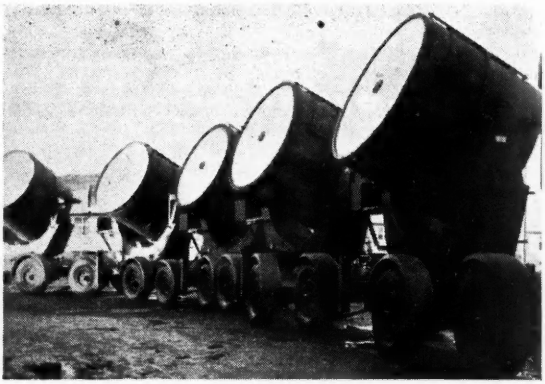
Mobile multiple rocket projector and (left) anti-aircraft gun fitted with hydraulic control system (Bruce Peebles)

thousands made less than half of one per cent. needed adjustment is an indication of the skilled craftsmanship.

To combat the magnetic mine large numbers of "de-gaussing" motor-generators were supplied, as well as many thousands of compass corrector coils and apparatus to counter the acoustic mine. As a contribution to the work of minesweeping, paravanes, Oropesa floats, and Dan buoys have been in more or less continuous production. Electrical plant for use on all classes of naval and merchant vessels has included generators for power supply, large motors for ship propulsion, and great

numbers of medium- and small-sized motors for driving deck and below-deck machinery such as pumps, fans and air compressors. Of special interest are the massive electric motors built for submarines and the large generators for aircraft carriers.

Bruce Peebles played a leading part in the development of anti-aircraft rocket guns, other guns including many anti-tank mortars. Co-operation with Imperial Chemical Industries, Ltd., resulted in the production of thousands of P.I.A.T. anti-tank mortars in record time. For the prefabricated "Mulberry" harbours the company manufactured a large number of pier pontoons and girders, and by day and night work succeeded in getting the parts to assembly points dead on scheduled time. Arc welding has helped to speed up production of vital materials and a vast amount of fabricated structures has been undertaken. At present, parts for emergency bridges and the like are under construction, the accuracy of the welding and machining ensuring that the parts are all exactly the same size.



Group of mobile searchlights equipped with operating gear for control from the predictors on anti-aircraft batteries (Bruce Peebles)

There has been great activity in the company's transformer shop, where some 75,000 small transformers and chokes for mobile radio transmitters for military units have been made. Power supply and transmission of electrical energy for the nation's factories has been a most vital part in Britain's war effort and for this essential service large power transformers running into many thousands of kVA have been supplied for the grid, including many 20,000-kVA transportable units for emergency service. Large numbers of transformers have also been supplied to essential industries and for providing electricity to war devastated areas. Electric motors and transformers totalling some 140,000 HP have been supplied to one group of factories alone engaged in the manufacture of T.N.T.

Rowlands Electrical Accessories, Ltd.

Some three years ago Rowlands Electrical Accessories, Ltd., were asked to assist in the development of certain weapons, then on the secret list, and for a very considerable period their drawing office, technical and development departments were engaged exclusively on this work. The most important of the projects was the development of the P.I.A.T. ("Projector, Infantry, Anti-Tank"). Working under the direction of Captain A. Hayton Cowap, of I.C.I. Metals, Ltd., they succeeded in getting the project into being in a very short time. Apart from development work the company has produced upwards of twenty million component parts for anti-tank weapons, including complete bombs, drum tails, loading clips, etc., as well as large numbers of other weapons including scores of thousands of the old original Blacker bombard.

S. Smith & Sons (England), Ltd.

So wide is the range of items made by the S. Smith & Sons (England) group of companies that it is difficult to know where to start in describing them. Developments on the electric clock side of the business include mine and torpedo mechanisms, barometers and process timers. Escapements for clocks and watches represent a particularly vital and specialised contribution to the war effort especially when supplies from Switzerland were cut off.

Instruments and apparatus for vehicles, tanks, aircraft and rescue launches have been made in great profusion and have included revolution counters; speedometers; air-speed, rate-of-climb and drift indicators; petrol pumps and fuel gauges; astro compasses; and sparking plugs of many special types. For armoured fighting vehicles the instruments have been reinforced.

Astral movements, submarine detectors, echo sounders, detonators for mines and torpedo mechanism are some of the items made for the Admiralty, while the R.A.F., besides obtaining from the company such equipment as automatic pilots, and height and air-speed units for bomb sights, has sent large numbers of its personnel to the factory for training in repair work. In factories the company's speed indicators have been playing an important part.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

New Symbol Wanted

WITH the end of the European war in sight and the resumption of competition between gas and electricity interests imminent, there is an urgent necessity for the adoption of a live symbol to succeed the cumbersome and somewhat sinister " Wizard in the Wall."

The largest potential domestic consumer group will be the married couples setting up house for the first time and it is essential that publicity should have maximum appeal to the 20–30 years age group.

I suggest that the " Wizard in the Wall " has a somewhat Victorian appearance and should now be replaced by, say, " Flic " or some such crisp and descriptive name. Electricity has for too long been burdened by a clumsy title in comparison with its principal competitor, and it is time that steps were taken to remedy the defect. Perhaps a competition could be started for modern advertising suggestions; doubtless E.D.A. could be persuaded to put up a prize but one essential condition should be that no judge is to be over forty years of age.

Birmingham. S. C. DINENAGE, A.M.I.E.E.

Shift Engineer's Complaint

MUCH time and patience have been expended in the past in acquainting other branches of the industry, through the columns of the technical journals, of the poor pay and working conditions of power station operating staffs. Being a comparative newcomer to the industry, and lacking the apathy which seems to grip older members, I am disconcerted by the misfortune which caused me to join the staff of one of our bigger stations.

No one will deny that shift work at the best of times is a drudgery, and it is high time that some compensation in the way of a shorter working week than the " tolerated " 48 hours was granted to the long-suffering, but docile, power station operative. I mentioned the " tolerated " 48 hours since I am assured that this is a normal working week. The station at which I am employed seems to have adopted a permanent 56-hour week with one day off a month. The excuse given is that " there's a war on," and staff is hard to get. The real reason, however, is that the power station moguls set too high a standard when engaging staff for a job which, in my case, a not too intelligent boy of 14 could satisfactorily perform.

Shift workers, like their more normal compatriots, look forward to their annual holiday. This company, worth several millions, is pleased to grant him one week off with pay, plus a second week in lieu of public holidays on which he has to work. For this concession he will have to sacrifice all his normal time off for the whole of the holiday period to cover the shifts of the absent member. Is this the usual practice?

Need I add that I am eagerly looking forward to the post-war relaxation of labour control. OVERWORKED.

Supply Authorities as Contractors

AFTER reading Mr. F. W. Purse's letter in your issue of April 13th, I still adhere to the opinions which I expressed. Since my letter appeared in the *Electrical Review* of April 6th, I have had expressions of opinion from men in the manufacturing, factoring and contracting sections of the industry who all endorse what I said. Naturally, I did *not* expect all supply engineers to agree with me but that is no reason why my opinions should be suppressed or that I should regret resurrecting an old subject.

It is nineteen years since the 1926 Act was passed and Acts can and do become out of date. The development of electricity supply since 1926 has been phenomenal and this is all the more reason why supply authorities, company and municipal, should be compelled to confine their activities to electricity supply and leave all wiring, repairs and sales of apparatus to those other traders to whom this business rightfully belongs.

I still call it a lop-sided method of trading that supply undertakings, having no competition and operating in a protected industry should use their powerful and safeguarded positions to weight the scales so heavily against the other sections mentioned. There is ample room for all if each section will confine its activities to its own particular sphere, and I see no reason why all sections should not make satisfactory progress with an ample reward if selfishness is dropped and a sensible and harmonious code of honour is adopted and adhered to.

Bradford. HARRY MOSS.

Pressure on Space

I WAS very pleased to read Mr. Butcher's letter on the above subject, and would like to add my support to his remarks, particularly with regard to the dispersion of technical articles into fragments scattered haphazard all over a journal.

I try to avoid subscribing to, or reading, any journal which perpetrates this abomination. I greatly value advertisements, but not when they interfere with other matters.

Ealing, W.5. N. HENDRY.

The Budget

INTRODUCING his Budget statement in the House of Commons on Tuesday, the Chancellor of the Exchequer (Sir John Anderson) said that we must revise our war policies with the minimum of time lag and must cut away ruthlessly what no longer served the essential purpose of defeating Japan.

Among the concessions proposed was an extension of the scope of the relief given last year to small businesses in regard to E.P.T. The Chancellor said that the relief would be based on the principle already applicable to small businesses in connection with N.D.C. Where the existing standard was less than £12,000 there would be an addition to the standard of one-tenth of the amount by which the existing standard fell short of £12,000. The cost of the proposal would be £12,000,000.

The Chancellor announced that a treaty had been signed between the United States and the United Kingdom with regard to double taxation. Withholding tax of 30 per cent. on dividends from the United States to Britain would be reduced to 15 per cent. and to 5 per cent. in the case of dividends received by United Kingdom companies from U.S. subsidiaries. Interest and royalties on a reciprocal basis would have a complete exemption of tax from the country in which they were derived and in which the recipient was not trading. Duties under the Safeguarding of Industries Act and the Import Duties Act would be restored to their former level when the war with Germany was over.

Dover Undertaking's Jubilee

A PUBLIC supply of electricity was commenced at Dover in April, 1895, and the Corporation took over the system in May, 1904. To mark the completion of fifty years' operation a luncheon was held at the Town Hall on Monday last.

Proposing the toast of the electricity undertaking Major G. Lloyd George, Minister of Fuel and Power, said that, despite having had 1,145 shells, 697 bombs and many other missiles, the work of the undertaking had gone on. Not only had the diminished population been supplied, but the Services had made extremely heavy demands. He paid a tribute to all those employed in electricity and gas undertakings not only in Dover but in the rest of the district which had been under attack. He made a further appeal for the greatest economy in the use of fuel and power during the coming winter, which was likely to be the most difficult of the war. Alderman J. R. Cairns, chairman of the Electricity Committee and former Mayor, replying to the toast, dealt with the origin and the growth of the undertaking.

Councillor W. J. Pudney, deputy mayor, proposed the toast of "The Electricity Supply Industry." Referring to the industry's war record, Lord Brabazon, president of E.D.A., said that Englishmen sometimes made too little of themselves. They had invented radar, now used throughout the world, and the Battle of Britain, which raged over Dover, was won by electrical inventions such as radar.

Col. the Hon. J. J. Astor, M.P., proposed the toast of the Mayor and Corporation, and the Mayor of Dover, Councillor J. Fish, J.P., replied. Responding to the toast of "The Guests," proposed by Councillor Gates, Sir John Dalton recalled that on one night in March last year 25 per cent. of Dover's supplies were knocked out by enemy action. That was at 11.10 p.m. By 12.15 a.m. the whole had been restored. He congratulated the borough electrical engineer, Mr. R. G. Widgery, on his achievement in maintaining supplies under such difficult circumstances. Mr. E. E. Hoadley, saying that his town of Maidstone had also been shelled, claimed some of the credit for Dover's record, for its engineer had at one time been his assistant.

Heating and Ventilation

THE heating and ventilating of large buildings are commented on in a general way in a short paper presented in London by DR. OSCAR FABER to the Institute of Fuel.

The need for co-ordinated planning of all the engineering services in a building is emphasised for the author's experience has shown that satisfactory results can alone be achieved in that way. Heating and ventilation must always be considered together. When a building is to be mechanically ventilated the author is generally in favour of the heating being done independently by direct radiation rather than on the plenum system, which is apt to create unpleasant warm draughts and cold walls.

Various kinds of heat emitters are mentioned and a tabulated direct comparison of cost per therm for different fuels at certain assumed prices is included. There are also tabulated data to indicate the weight of coal needed per therm of useful heat delivered to the building when using electricity, gas, oil, or coal, at various prices. Figures are added to represent district heating installations served by a straight heating station and a combined heating and power generating station. The author declares that it will be apparent from his argument that if national coal resources are to be regarded as an important criterion in the choice of fuel for heating, then "vast schemes" of electrical heating, whether direct or thermal storage, should not lightheartedly be embarked upon.

The paper includes a list of large buildings heated by different means with very brief notes thereon. A schedule of some of the large district heating plants abroad was submitted with, and is included in the printed version of, the paper which concludes by raising the issue whether in this country numerous boilers and other small heat-producing units should continue to be installed in new buildings or whether larger centralised systems of district heating should be embarked upon. In the author's opinion combined district heating should be examined very carefully as involving the lowest coal consumption for a given heat output and offering other savings.

I.E.E. Students' Summer Outing

A SUMMER outing to Stratford-on-Avon to see "Twelfth Night" at the Memorial Theatre has been arranged by the I.E.E. South Midland Students' Section for Saturday, June 16th. Members wishing to take part should write as soon as possible to the assistant secretary, Mr. D. L. Watkins, 7, Arundel Crescent, Solihull, Warwickshire, enclosing the reduced price of 3s. 6d. for each seat required.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AMONG the party of French industrialists who are visiting this country at the invitation of the Federation of British Industries are **Monsieur Ernest Mercier,** President of the Electrical Union, and **Monsieur Boutteville,** President of the General Syndicate for Electricity. The party, which will arrive in England next Wednesday, will be accompanied by **Mr. Edward de Muralt,** F.B.I. representative in Paris.

Mr. E. C. Holroyde, joint managing director of Crompton Parkinson, Ltd., has been elected chairman of the Council of the British Electrical and Allied Manufacturers' Association. He succeeds **Sir Harry Railing,** chairman of the General Electric Co., Ltd., who now becomes vice-chairman.

Mr. E. J. Jarvis, borough electrical engineer of Kingston-upon-Thames, has been appointed to the Central Board's Consultative Committee for S.E. England, not the National Committee as reported in our issue of April 13th.

Professor Sir Lawrence Bragg has been re-elected chairman of the X-ray Analysis Group of the Institute of Physics.

Mr. N. Hunter, M.I.E.E., although not officially taking up his new duties as general manager and engineer of the Stockton-on-Tees Electricity Department until May 25th, has been permitted by Morley Corporation to spend two days a week at Stockton in view of the urgency of the work there. Ill-health made it necessary for **Mr. S. G. Marston,** M.I.E.E., to retire last February after twenty-three years as "chief" at Stockton.

Mr. E. Cooper, who for the past eight years has been superintendent of the English Electric Company's domestic appliance work at Preston, has joined Clifton Aircraft, Ltd., as general manager of the Appliance Division and will be responsible for the company's venture into the domestic appliance industry. After being educated at the College of Technology, Manchester, Mr. Cooper gained experience with the Pressed Steel Co., Ltd., and later was for four years with Ferranti, Ltd., Hollinwood, and for four and a half years with Measurement, Ltd.

Mr. W. H. Langstone, for thirteen years in the domestic design office of the English Electric Co. has joined Clifton Aircraft as chief designer to the Appliance Division. Previously Mr. Langstone was for five years in the design office of the G.E.C. at Landor Street, Birmingham, and later with Johnson & Phillips, Ltd.

Mr. H. P. Bolton recently retired from the position of general president of the Electrical Trades Union which he had held since 1941. He is succeeded by **Mr. F. Foulkes,** who has been national organiser of the E.T.U. since 1941.

Mr. W. J. Turner has resigned from the board of Franco Signs, Ltd., but retains the position of sales manager of the company's sign business. **Mr. G. S. Campbell,** A.C.A., has been elected a director of the company.

The Earl of Gowrie has joined the board of Siemens Bros. & Co., Ltd.

The Portsmouth City Council is advertising in this issue for an engineer and manager for its electricity undertaking. The present engineer, **Mr. B. Handley,** who was due to retire in 1942, has been carrying on. The salary offered is in accordance with the Walker scale but in the first year only 85 per cent. will be paid, rising to 92½ per cent. in the second year and to the full amount thereafter.

Lord Margesson, who, as Capt. Margesson, M.P., was formerly Secretary of State for War, has joined the board of International Combustion, Ltd. Since 1942 he has been a director of the General Electric Co., Ltd.

Mr. T. W. Middlemiss, who had been in the employ of W. T. Henley's Telegraph Works Co., Ltd., for nearly half a century, has received a presentation from his colleagues on the occasion of his retirement. In passing on this gift Sir Montague Hughman, chairman of Henley's, said that Mr. Middlemiss had worked for the company in many parts of the world. He began straight from school at the North Woolwich works. After his transfer to the Outdoor Contract Department he was engaged as assistant engineer on many contracts both at home and abroad, including Barbados, the Central Argentine Railway, Buenos Aires, Chicago, Capetown Suburban Railway, etc.

Mr. G. Hicks, mains superintendent in the Fulham Borough Council Electricity Department, is retiring next month. He has been with the undertaking since 1912.

Mr. E. W. Bechervaise, A.M.I.E.E., senior engineer-in-charge with the Portsmouth Electricity Department, has been appointed relief assistant operating engineer at Fulham power station.

Councillor C. A. Goodall, chairman of Leeds Corporation Electricity Committee, has been elected chairman of the Mid-East England Centre of the Incorporated Municipal Electrical Association.

Mr. G. F. Mansbridge has relinquished the chairmanship of Dubilier Condenser Co. (1925), Ltd., as he desires to be relieved of some of his responsibilities. He will remain a director. **Mr. W. H. Goodman,** the deputy chairman, succeeds him as chairman.

Mr. A. R. Walter retired last week from the City of Chichester Electricity Department, after having served for five years beyond the normal retiring age of sixty-five. He has seen fifty years' continuous service in the electricity supply industry, having commenced under the late Sir Horace Boot at Tunbridge Wells in 1895. He joined the Chichester Electric Light & Power Co., under the late Mr. R. V. Weare, in 1909, and remained with the undertaking when it was taken over by the Corporation in 1923. At Chichester Mr. Walter worked in progressive capacities in the mains department and finally attained the position of acting city electrical engineer on the death of Mr. Weare in April, 1943. At a farewell tea party (given by Mr.

Walter) on April 10th he was presented, on behalf of the staff, with an illuminated address signed by the members of the undertaking, a framed photograph of the staff, taken especially for the occasion, an engraved electric clock, and an electric fire.

Mr. W. W. Syrett has joined E. K. Cole, Ltd., as export manager. Mr. Syrett was previously foreign manager of one of the clearing banks. He has written many articles on international banking and trade finance and a book entitled "Practice and Finance of Foreign Trade."

At the Brook Motors, Ltd., works on April 19th, eleven further employees who have attained 25 years' continuous service with the firm, were presented with various gifts by the chairman, **Mr. Ernest Brook**, who was introduced by **Mr. Joseph L. Brook**, vice-chairman.

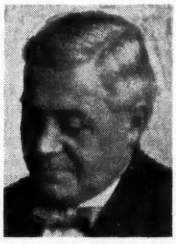
Mr. J. H. Mahler has been appointed a director of Alfred Herbert, Ltd., in place of the late Mr. Ralph Jackson and **Mr. D. M. Gimson** has resigned from the board.

Mr. F. J. Cole, whose new appointment was mentioned in our last issue, is going to Blackpool, not West Bromwich as stated. He has been electrical engineer of the latter county borough for the past six years.

Mr. J. N. Sicard was recently appointed general manager of the Quebec Power Co. He takes over the duties of **Mr. J. E. Tanguay**, vice-president and managing director, who recently retired.

Obituary

Mr. W. Wyld.—We regret to record the death of Mr. William Wyld, M.I.E.E., M.I.Mech.E., which occurred on April 17th, at the age of seventy-two. Mr. Wyld was born at Bishop Auckland, Co. Durham, where he received his education at the Lightfoot Institute. After a seven years' mechanical apprenticeship he took a three-year course at Firth College, Sheffield, and at the Sheffield Technical School (now Sheffield University). In 1895 he joined the Blackpool Corporation Electricity Department as technical assistant and two years later became chief assistant with the Salford undertaking. After two years as electrical engineer to the Patent Shaft & Axletree Co., Ltd., Wednesbury, he became borough electrical engineer and tramways manager at Doncaster in 1901 and three years later took up a similar appointment at Birkenhead. From 1913 to 1921 he was chief engineer and manager of the Hampstead Borough Council Electricity Department and subsequently he was sales engineer with the Spearing Boiler Co. which was taken over by the Vickers Boiler Co., Ltd., and with Babcock & Wilcox, Ltd.; he retired in 1932.



The late Mr. W. Wyld

Mr. Wyld was a member of the I.M.E.A. Council for over ten years. He was one of the original members of the Municipal Tramway & Transport Association (now Municipal Passenger Transport Association) Committee for several years and also on that of the Tramways, Light Railways and Transport Association (now merged in the Public Transport Association Inc.). In 1920 he was president of the Batti Wallahs' Society.

Mr. T. R. Whitehead, whose death at Scarborough is reported, was formerly engineer and general manager of the Coventry Corporation Transport Department. He joined the original Coventry Tramways Co. in 1895 and the steam system was electrified under his management. He remained in charge when the undertaking was acquired by the Corporation in 1912, retiring in 1933, when he was succeeded by the present engineer, Mr. R. A. Fearnley. Mr. Whitehead was seventy-seven years of age.

Mr. W. G. Thomson, who has died at Aberdeen, taught mathematics at Robert Gordon's College for twenty-five years. He did research work in electricity at Aberdeen University under the direction of Professor Paget Thomson and read a paper on "The Discharge of a Condenser Through a Gas at Low Pressure" before the Royal Society of Edinburgh in 1937. He was fifty-seven.

Stores Control

THE control of stores for electricity supply undertakings was the subject of a paper by MR. W. G. WESTON (administrative officer, City of Norwich Electricity Department) submitted to last month's meeting of the Electricity Supply Administrative Association.

After dealing with coding alphabetically and in numerical sequence, sectional racking and the fixing of maximum and minimum stocks of parts and components the paper advised the compilation of a coded stores catalogue, the value of which would be appreciated when it was remembered that some undertakings carried 10,000 or more different items in stock.

While it might often be unwise to deny the storekeeper the right to keep his own set of movement cards, the paper favoured the setting up of a Stores Control and Central Purchasing Section as a sub-division of the general administrative office, or costing office (not in the stores) working in collaboration with the purchasing office and accounts clerks, with coloured cards to indicate different depots. The system recently introduced by the author was a "visible" one designed to indicate by means of a numerical scale on the insert strip of the index card, moved backward and forward to signal the rise and fall of stocks at each depot, when the stores control clerk needed to notify the purchasing office of the necessity for replenishment.

The subsequent discussion stressed the need for research into methods of stores control. With regard to stocktaking, it was shown that some items (lamps, for instance) needed to be checked more often than twice annually while one check per year would suffice for others. It was accepted as fundamentally wrong that all checking should be undertaken by the stores control staff; it should be done independently preferably from the audit section.

In the absence of the author the paper was sponsored by MR. J. E. ROBERTSON (Hackney), the chairman of the meeting.

Equipment for Overseas

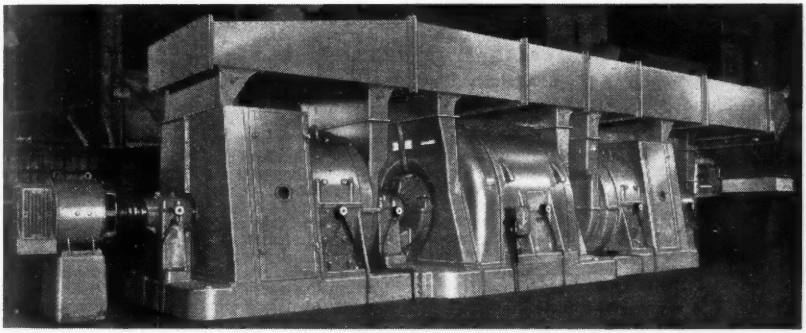
A Variety of Exports by the G.E.C.

PROMINENT among the varied kinds of plant and apparatus in course of manufacture or recently completed by the General Electric Co., Ltd., are many items destined for Dominion and foreign markets. Examples of heavy engineering are two 37,500-kVA 3,000-RPM turbo-alternators for South Africa that are similar to seven to be installed, in some cases with switch and control gear, in British stations. Both turbine- and motor-driven blowers and compressors are awaiting shipment to South Africa, where (in the West Spring mines) the first devaporising turbo-compressor has been put into commission. In marine work a large number of DC geared turbo-generators of up to 1,000 kW and four equipments for electrically propelled cargo ships including turbo-alternators to supply 6,800-SHP propulsion motors have been built.

The U.S.S.R. is receiving a large amount of plant, including three 31,000-kVA and three 15,000-kVA turbo-alternators and a number of 500-kW transportable power units embodying a turbo-alternator, transformer and a four-unit cubicle switchboard. The G.E.C. has been responsible for a complete power station for the same country from the coal-handling plant to the high-voltage switchgear and containing at present one 15,000-kVA turbo-alternator. Other items for Russia include a great number of motors, some of which are flameproof squirrel-cage machines rated at 125 HP at speeds from 1,460 to 730 RPM, and three forced-ventilated motor-generator sets for an electro-chemical works, each of which comprises a synchronous motor driving two DC 10,000-A and 230-280-V generators.

Noteworthy among the switchgear supplied to Dominions are thirty-six 33-kV 1,000-MVA units for Pyrmont station of Sydney County Council and 150 " Subgear " units. A new range of metal-clad gear embodying low-oil-content circuit-breakers for any voltage between 6·6 and 33 kV and up to 1,500 MVA has been introduced; for 66 kV the design is of the outdoor type. To the range of metal-clad " Subgear " has been added an 11-kV 50-MVA unit with on-load busbar selection by means of oil-immersed switches. As a consequence of the new draft Mines Regulations a new range of Buxton-certified flameproof compact mining-type switchgear has been introduced for either high or low voltages with an associated 500-W transformer. The great variety of transformers manufactured included one rated at 37,500 kVA star-star, 66/22 or 11-kV, with delta tertiary winding rated at 10,000 kVA (O.F.W.) for the Electricity Commission of Victoria.

Increasing use of salient-pole synchronous motors is reported for driving compressors, fans and similar equipment, an example of which is a 120-RPM, 1,500-HP, 2·2-kV motor running at 120-RPM in a South African mine. Large AC and DC motors also form part of the plant supplied for the complete electrification of rolling mills and collieries or for modifications to existing installations. For the Sydney Docks scheme (Australian Government) three 1,200-HP 5-kV salient-pole machines of this type have been provided for driving dewatering pumps in addition to a large number of other types of motors ranging from 1½ to 230 HP for driving pumps and valves, all centrally controlled. Incoming supplies and the large



Heavy-current motor generator for Russia

motors are controlled by a double-bus 150-MVA solenoid-operated switchboard. The contract also covers a stand-by power station comprising three 1,250-kVA 5-kV Diesel-alternators and auxiliary equipment. Other aspects of Empire development are presented by the installation of complete mechanical and electrical equipment for a large iron-ore concentrating plant in West Africa and by the installation of major

33-kV heavy duty metal. clad switchgear (Sydney County Council)

installations for the centralised control of distribution and traction systems and for ripple control of water heaters in five countries besides Great Britain.

Apart from the large amount of plant made for specifically war purposes, some of it in new factories, the more normal activities of the G.E.C. and its associated concerns have been kept in being to the extent permitted by prevailing conditions and its overseas organisation has been kept intact except in enemy-occupied countries. Mention only can be made here of numerous other current developments, such as pumpless air-cooled steel-tank rectifiers for traction and electrolytic duties, direct-to-line-started squirrel-cage motors up to 750 HP, an improved wave trap for carrier-currents on power lines, lifts, welding equipment, fluorescent and other lighting, electric furnaces, radiant and infra-red heating, measuring instruments, cables, plastic insulation and equipment for domestic purposes.

Town and Country Planning

Electricity Undertakings' Position

THE Electricity Commissioners have drawn the attention of authorised electricity undertakings to some of the provisions of the Town and Country Planning (General Interim Development) Order, 1945 (S.R. & O. 1945/349) which comes into force on May 1st, and have circulated an explanatory memorandum produced by the Ministry of Town and Country Planning. Reference is made to "permitted development," *i.e.*, development which can be carried out without first obtaining interim development permission. Under this heading (Class II) falls development sanctioned by any Government Department, including the Electricity Commissioners, before the commencement of the Order. It is intended to provide for the review of sanctions already given where their exercise would be in some serious respect in conflict with present proposals for planning an area.

Class V of permitted development includes (i) development of any description below the surface of the ground, and (ii) the provision of any overhead line for the supply of electricity in accordance with the provisions of any enactment. While it will not normally be necessary for undertakings proposing to apply for the consent of the Minister of Fuel and Power to erect overhead lines in any area to which the Order relates to make any separate application for interim development consent, the Minister has agreed that he will, before giving his consent under the Electricity (Supply) Acts, refer to the Ministry of Town and Country Planning certain types of cases, including (a) any case in which the Minister of Fuel and Power receives an objection from a local authority on amenity grounds; (b) any proposal which involves the use of certain specified types of structure which might conflict with amenity; and (c) other types of application which present special features.

So far as new construction is concerned, the main types of development in respect of which it will still be necessary for undertakings to apply for interim development permission will be any new buildings or extensions of existing buildings and such structures and erections as are not covered by paragraph 4 of Part I of the Schedule, *e.g.*, chimneys, external coal conveyors or cooling towers not coming within the category of sub-paragraphs (3) or (4) of paragraph 4, or substations, feeder pillars or transformer kiosks of stone, concrete or brickwork.

It should also be specially noted that in certain cases and subject to certain qualifications, the automatic permission may be excluded either as respects a particular area or in any particular case.

The procedure to be followed in respect of those limited classes of development for which electricity undertakers are required to obtain interim development permission is set out in the Order.

Public Lighting Conference

The Association of Public Lighting Engineers proposes to hold a conference in Glasgow from September 11th to 13th.

Thermal Rating

Importance as a Safeguard Against Failure

By H. Astbury, M.I.E.E.

IN general, the thermal rating of electrical machinery or apparatus is determined by its maximum working condition, while for motors, for example, specified overloads are permitted for a definite period of time.

The thermal rating of a motor can be readily determined on test by ascertaining that the temperature rise does not exceed that laid down in the appropriate British Standard Specification. In machines acting as generators, however, whilst the normal-load and overload ratings still apply, the current which can be generated may greatly exceed the normal rating under fault conditions. Then the current which will flow will be limited only by the impedance of the machine windings and the conductors from the machine terminals to the point of the fault. Similar conditions apply to transformers.

Some maximum time limit must be set if the conductors constituting the winding and their insulation are not to be permanently damaged. This is one of the prime functions of switchgear, through the medium of which various forms of protection can be arranged to disconnect the machine or transformer concerned from an external fault or in the event of an internal fault.

Switchgear must therefore not only perform normal switching operations with safety but also protect the system as a whole against faults and not a particular piece of apparatus or part of a system (except in the case of overload or internal fault), which should be disconnected if it is considered that its continual operation would have deleterious effects on the main system.

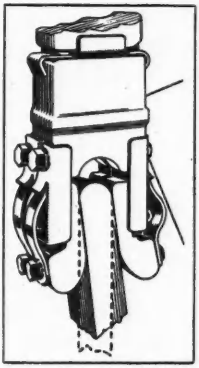


Fig. 1.—Self-aligning finger contact *(Patent No. 549825)*

The short-circuit rating of switchgear is now commonly certified by the Association of Short-Circuit Testing Authorities as a result of a type test for a particular switch in accordance with the appropriate clauses in B.S.S. 166 or B.S.S. 936. Whilst thermal ratings are also defined in these specifications, it is less usual for them to be proved and they have in the past been assigned on theoretical and calculated values only.

Some forms of protective system rely for their discriminative operation on definite time delays, which may be set up to 4 sec. If such a time delay is used, it follows that ancillary apparatus such as current transformers, the primary of which is connected in series with the system, must also withstand the maximum short-circuit current for not less than the maximum time delay.

The great energy required for tests can be provided only in a short-circuit testing station expressly designed for determining the short-circuit and thermal ratings, where facilities exist for accurate measurement and observation during the tests.

In this connection, it has been assumed that current decrement during the progress of the tests is a *sine qua non* (see Fig. 16 of B.S.S. 116, Part 1). Improvements in the control of the excitation of testing generators have, however, enabled a level value of short-circuit current to be produced for a normal period of a thermal test, which is five seconds. Indeed, an increment of current can be obtained over this period, if so desired.

In thermal tests on complete switchgear units the mechanical forces due to the short-circuit current on the conductors and the supports are also applied, and such apparatus as isolating switches are tested to determine whether a switch could open inadvertently on short-circuit. Mechanical forces, however, can be calculated and provided for. The thermal rating on the other hand is dependent not only on the section of the conductor but also on the degree of contact obtained at bolted or other forms of joints and, in a greater measure, at contact points which are usually dependent upon a spring, no matter how it is employed.

Various works have been published showing the relative efficiency of line and surface contacts under varying pressures. Contacts, however, deteriorate in service, particularly copper-to-copper and, to a lesser extent, silver-to-silver, due to oxidisation of the surfaces. In some designs, the forces due to short-circuit current act in such a manner that the contact pressure is reduced by one contact member being repelled by the other, the minimum thermal rating being thus available when the maximum is required. The thermal rating of a switch is, therefore, of equal importance to its interrupting capacity (certainly, it would affect the making capacity in a large measure) and is as important in every component of a

switch unit as it is in the oil circuit-breaker, particularly as regards isolating contacts and current transformers.

A series of tests has been carried out on a new design of finger contact in which the tendency is towards increased pressure between the contacts when carrying the short-circuit current, and this in itself introduces other implications. With increased pressure between the contact surfaces, the force necessary to withdraw the contact on opening, becomes greater, and unless the correct force has been applied the switch may be prevented from opening, even though the mechanism has been released, thus not performing its prime function of opening the circuit when the relay system determines this to be necessary.

Similarly, the contact finger must be prevented from movement due to short-circuit, in whatever direction, but it must be left free to move under the action of its control spring which determines the contact pressure. The ideal contact pressure can be determined only by having all the above factors in mind and it is generally reached after careful experiments and not by the use of empirical data.

In the controlled tests mentioned, it was possible to substitute springs producing various pressures, to ascertain the effect of reduced contact area, to reduce laminations which connect the contact finger to the contact block proper to an irreducible minimum and, from this, to determine the correct factor of safety, such as can be expected under normal manufacturing conditions or after replacement of contacts during maintenance.

The ideal contact in this respect should be one which requires no fitting of any description to ensure adequate contact surface and pressure, as the time factor is such that the operation of fitting contact replacements would take far too long under ordinary maintenance conditions, even if the skill were available.

The form of self-aligning contact on which the tests were conducted is illustrated in Fig. 1, which is drawn diagrammatically to show the degree of mal-alignment which is possible whilst maintaining satisfactory contact. Three typical thermal-rating tests are illustrated in Figs. 2, 3 and 4. In these tests the voltage drops across the test pieces are also recorded.

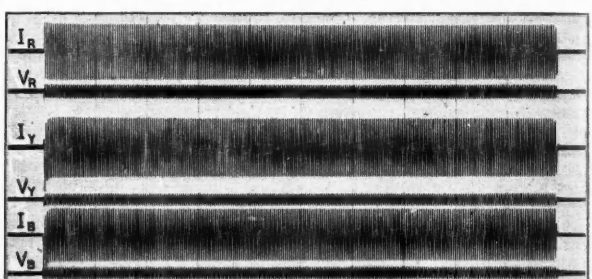


Fig. 2.—Oscillogram of 5 sec. test in which 27,000 A (RMS) was maintained at constant value throughout

Series overload coils provide another instance of the great importance of thermal capacity. The switch on which they are fitted is usually arranged for a given short-circuit rating with the smallest section of conductor used for the series coil, any time delay usually being adjusted to the maximum. As the overall short-circuit rating may be determined by the thermal capacity of the series coil, the switch is derated progressively with the decreasing size of the series coil conductor.

The reduction in the size of the latter is necessitated by the greater number of turns

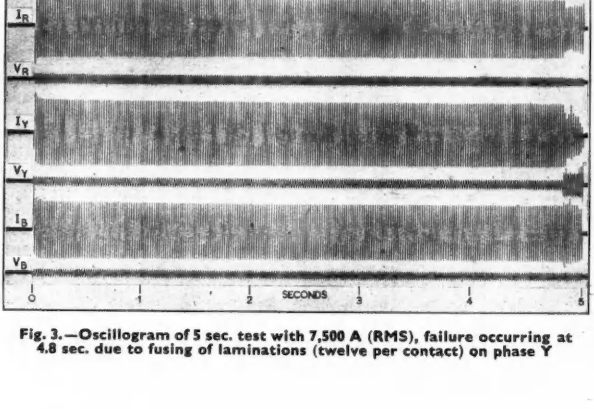


Fig. 3.—Oscillogram of 5 sec. test with 7,500 A (RMS), failure occurring at 4.8 sec. due to fusing of laminations (twelve per contact) on phase Y

required to produce the requisite ampere-turns to operate the electro-magnetic tripping device, the space factor being limited by the coil winding space. The coil must also, in itself, withstand any mechanical forces to which it may be subjected.

In medium-voltage switchgear, small wiring connections have often to be taken from the busbars or phase conductors for the operation of instruments, relays, meters or under-voltage releases. As these connections cannot have thermal ratings sufficient to cope with the short-circuit current, a convenient safeguard is to install close to the point of connection to the busbar or phase conductor a high-rupturing-capacity fuse of approximately 30-A rating with a substantial connection between it and the conductor. The cut-off value of the fuse must be such that the fusible element will melt and disconnect the circuit before the small wiring is damaged by heating.

The short-circuit energy which can flow from power transformers is limited by the short-circuit capacity of the system to which the primary is connected and to the impedance of the transformer itself. All these factors should be known and the thermal rating of the transformer under short-circuit conditions should be guaranteed for a period determined by the maximum time during which fault conditions are allowed to persist. Similarly, the winding of a reactor constitutes a primary conductor and its thermal rating must allow for the maximum short-circuit current for a like period.

Whilst this most important factor is taken care of by reputable manufacturers of the apparatus or machinery, the problem is not always fully considered when selecting cable sizes for feeders or interconnections, which on account of possible short-circuit conditions may require to be disproportionately larger than their normal rating.

The maximum final temperature which constitutes the safe limit for paper-insulated cables is still a subject of research, but in considering their short-circuit ratings the normal working-temperature must be taken into account, so that the difference between the two temperatures may be sufficient for the extra heating during the short-circuit.

The duration of short-circuit which, at a given current, will determine the final temperature of the cable must be forecast having full knowledge of the form of protection employed as well as the operating characteristics of the disconnecting switch. The short-circuit rating of a given size of cable will not be the same for all types, and it must, therefore, be based on a recommendation by the cable manufacturer.

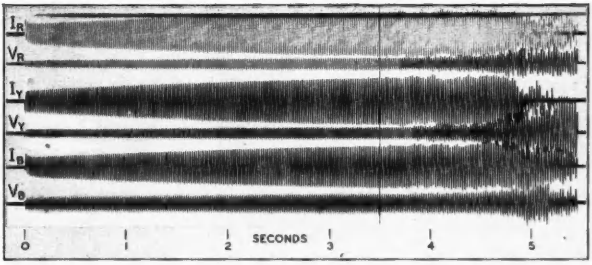


Fig. 4.—Thermal test on rising-current characteristic, 18,200 to 43,200 A at 3.5 sec.; subsequently excessive arcing at 46,500 A caused failure

Where a reliable h.r.c. fuse is used, the thermal rating of the cable can be safely assumed to be greater than that of a properly selected fuse. In other forms of protection intentional delay may be introduced into the tripping operation, particularly with relays having definite time delays, and the selection of a cable having the smallest conductor is poor economy. Other factors, such as the bursting strength of cables or the displacement of conductors, must be taken into account. The necessity of complete consideration of the thermal factor in every conductor used, whether in a piece of machinery, apparatus or cable must be emphasised.

Short-circuit testing stations in this country are able to provide accurate data in all the circumstances referred to above, under controlled conditions which are adequately recorded. They provide a means of eliminating bad designs and safeguard the user against the failure, with disproportionate consequences, of what may be quite a small part of an electrical system.

Thanks are due to Crompton Parkinson, Ltd., for permission to reproduce the illustration and oscillograms.

Simplified Screw Thread System

ACTIVE investigations are in progress in America, Canada and this country to see whether it may be possible to reach agreement on a screw thread system acceptable to all three countries. In Great Britain the matter is being dealt with by the British Standards Institution, whose Screw Threads Committee has recently issued a questionnaire to obtain guidance as to the views of industry on the most suitable pitch/diameter series for bolts, nuts, studs and fixing screws. Industrial firms which are prepared to assist by expressing their opinions on the matter are invited to apply for a copy of the questionnaire to the B.S.I.

Amended I.E.E. By-Laws

Council's Responsibilities Increased

AS a result of suggestions received from time to time from members, staff and legal advisers, the Council of the Institution of Electrical Engineers decided on certain revisions of the by-laws, which have existed in their present form since 1929. The new draft was discussed by corporate members on November 23rd last, and, with slight amendments, was submitted to the Privy Council as required by the Royal Charter of incorporation. The changes were allowed by the Privy Council on February 16th.

One of the most notable alterations is that which places on the Council full responsibility for the election and transfer of members. The former procedure (under which election was by ballot of corporate members present at an ordinary meeting) had been criticised on the grounds that it did not provide a representative mechanism, since voting was restricted to members present at an ordinary meeting and previous intimation of the holding of a ballot could only be obtained at the Institution itself. Moreover in the summer, when no ordinary meetings are held, elections and transfers were held up. The names of candidates after approval by the Council will in future be published with the *Journal* and one month later their applications for election will be considered by the Council in the light of any further information it has received. The power of the Council to permit students in special cases to remain in that class after reaching the age of twenty-eight is now specifically stated.

Position of Vice-Presidents

Vice-presidents are now eligible for re-election for a further period of three years after having served for a similar period. This obviates the risk of loss of touch with Institution affairs in the case of a vice-president who has been out of office for one or more years before nomination as president. Also their number has been increased to five, in order that the major committees may have vice-presidents as chairmen and that the duties of visiting local Centres may be more widely spread.

Among several amendments intended to make for convenience in the election and working of the Council is one that removes from office those ceasing to take an active part and another that limits the number of past-presidents with voting powers to the three last in office, other than any serving on committees. The last provision previously related only to voting on the Council by ballot. Past-chairmen of local Centres who are members of the Council are now entitled to vote instead of normally being merely in attendance.

Another revision requires the professional conduct of all members to conform with that formerly enjoined on members engaged in an advisory or consultative capacity.

A possible hardship on those who are only nominally "enemy aliens," in that they automatically cease to be members, has been removed by permitting the Council to exercise discretion in their favour. Other revisions are devised generally to clarify existing provisions or to bring them into line with present conditions.

Employers' Right of Suspension

IN the Court of Appeal on April 19th, Lord Goddard and Lords Justices MacKinnon and du Parcq heard an appeal by Mr. Stanley R. Marshall, Stoke-on-Trent, against a decision by Mr. Justice Singleton in an action which the appellant brought against the English Electric Co., Ltd., at whose Stafford Works he was employed, claiming a declaration that the company had no right to suspend him. The case was reported in the *Electrical Review* of December 15th last (p. 855). The plaintiff had been suspended for three days in January, 1944, for indiscipline and he had appealed to a local committee under the Essential Work Orders; the committee ruled against him. The company's case was that it was an implied condition of plaintiff's employment that he could be suspended without pay for indiscipline and that this was a practice in that part of the country. The judge accepted this and gave judgment against the plaintiff.

In giving judgment on the appeal Lord Goddard said it had been proved that the practice of suspension was observed at the company's works and it was unnecessary to prove that the practice was general in Staffordshire. What was called suspension was in fact dismissal with an offer of re-employment after three days. If there were no Essential Work Orders the question would not have arisen, but as in his opinion the Orders recognised the practice the appeal should be dismissed. He did not agree that a trade usage in relation to suspension had been proved.

Lord Justice MacKinnon agreed but Lord Justice du Parcq thought that the appeal should be allowed. He said he did not think that suspension had been inflicted on Mr. Marshall in accordance with his terms of service, nor did he think that if an employee elected to agree to suspension he did so under his contract. The employers had failed to prove a practice of a kind that would import a term under which the penalty of suspension might be imposed, nor had they proved a contractual right to suspend the appellant.

The appeal was dismissed but leave to appeal to the House of Lords was given.

COMMERCE and INDUSTRY

Indian Industrial Proposals. Further Scottish Scheme.

Contract Price Adjustment Formulæ

THE latest figures for the B.E.A.M.A. contract price adjustment formulæ are as follows:—(*a*) Rate of pay for adult male labour at April 14th, 90s. 6d. (no change); (*b*) Cost of material: latest Board of Trade index figure for intermediate products (April 14th) is 179·6 and is the figure for March (against 176·9 for February).

Industrialisation of India

Proposals for industrial development were announced by the Government of India this week including the control of electric power and of transport. It is intended that the bulk generation of electricity shall remain the concern of the provincial governments as far as possible but apparently the Government of India intends to introduce some form of co-ordination. Other important industries will also be taken in hand by the central Government; among them the production of electrical and heavy machinery is mentioned. The general policy seems to be to leave most industries in the hands of private enterprise but with a supervisory control designed to secure co-ordinated development. For this purpose licences will be granted for the opening of factories, the Government being advised in this matter by a specially-constituted board.

Hams Hall Chimneys

A note in the *Birmingham Mail* states that in the near future the city will have what will probably be the largest twin brick chimneys in the world, for the one at Hams Hall generating station is to have a companion, identical in all respects. The contract for supplying all the materials and erecting the chimney has been placed with P. C. Richardson & Co. (Middlesbrough), Ltd., who erected the other one in 1940-42. It is to be built at a point about 200 ft. from the present one, and will rise 400 ft. above ground level, with an internal diameter at the top of 22 ft. Over 2,000,000 bricks, it is estimated, will be required for the new chimney, which will stand on a reinforced concrete raft 75 ft. square and 9 ft. thick. The dead weight on the subsoil will be about 10,000 tons, the wind load adding a further 25 per cent. The contract price, exclusive of all foundation work, which will be done under another contract, is in the neighbourhood of £50,000. A feature of the structure, which will take 18 months to complete, will be an electric passenger hoist running up the centre.

Wrongful Dismissal Action

In the King's Bench Division of the High Court, on April 13th, Mr. Justice Birkett concluded the hearing of an action by Dr. Eric James Rigby of Strand-on-the-Green, Chiswick, against Coley Electrical Instruments, Ltd. of Brentford, to recover damages in respect of his wrongful dismissal.

Dr. Rigby is an expert specialising in research work in connection with electrical instruments. His case was that he went to the defendant company in 1941 and ultimately designed an electrical instrument, which was asked for and adopted by a Government Department, who gave defendants a generous order. He became a director of the company and received a salary of some £600 a year. Trouble arose in 1943 and as the result plaintiff was dismissed by the company. He now claimed that he was entitled to six months' salary, as six months was reasonable notice. Defendants contended that plaintiff was only entitled to one month's notice and denied that the termination of his employment was wrongful. His Lordship held in favour of the plaintiff and awarded him six months' salary. As plaintiff had done a certain amount of work during the period, the amount would be deducted from the sum he was entitled to. The result was that there would be judgment for the plaintiff for £254 with costs.

E.D.A. Kitchens

The electric kitchens, which the British Electrical Development Association has designed for low-cost post-war homes, are to be exhibited in the provinces as follows:—Cardiff: (Howells Stores, St. Mary Street), April 30th to May 19th. Edinburgh: July 2nd to July 21st. Newcastle: September 3rd to September 22nd. Sheffield: November 5th to November 24th. Birmingham: January 7th to January 26th, 1946.

It has not been possible to obtain permits to build duplicates of the kitchens, so that each area has to await its turn for the exhibition which was shown at the London Building Centre with great success for eleven weeks The long intervals between the exhibitions is explained by the fact that the kitchens require two weeks for dismantling, one week for transporting from place to place, and three weeks for erection. The Cardiff exhibition is to be opened by Lady Herbert Lewis and there was a pre-view of the exhibition to the members of the South West England and South Wales Committee of E.D.A. on Wednesday, April 25th.

Aluminium Exhibition

The newly formed Aluminium Development Association (of which the Hon. Geoffrey Cunliffe is president) is sponsoring an aluminium exhibition, opening at Selfridges, Oxford Street, London, W.1, on May 30th.

Highlands Water Power

Constructional Scheme No. 3 (Fannich Project) which has been prepared by the North of Scotland Hydro-Electric Board, approved by the Electricity Commissioners and submitted to the Secretary of State for confirmation, has now been issued. It is proposed to convey the waters of Loch Fannich in Ross-shire by tunnel and pipeline to a power station having an installed capacity of about 24,000 kW at Grudie Bridge in Strath Bran. The scheme involves an estimated capital expenditure of £1 million and will require about 500 men to carry out. Describing the scheme, Lord Airlie, chairman of

the Board, said that the aim was to attract industries to the area (which has good road and rail connections and is near the town of Inverness) as well as to meet local electrical requirements. The scheme was expected to be one of the economic Highland water-power developments, the financial surplus from which would support the construction of smaller schemes in the Highlands and Islands which could not be otherwise undertaken.

Fine Wire Exhibition

The Minister of Aircraft Production (Sir Stafford Cripps) recently opened an exhibition at the works of Fine Wires, Ltd., Nottingham, intended to show the employees how their work has helped in the conduct of the war. Most of the company's production is used in instrument and similar work and the display included a range of apparatus employed by the Royal Air Force and the Army. Before the war the company produced elastic yarn and its experience proved useful in the production of fine wire insulation.

Agents in Overseas Markets

The Statistics and Inquiries Department, London Chamber of Commerce, informs us that it is receiving many applications from agents abroad wishing to represent British manufacturers and exporters. Members who make requests to the Department, quoting the country in which they are interested, will be supplied with particulars of names and addresses of the agents and of their references. It is emphasised that references should in all cases be taken up before entering into any agreement.

London Chamber of Commerce

The annual report of the London Chamber of Commerce states that membership now totals 11,223, its forty-six affiliated associations having a total estimated membership of 50,000. Among the various sections of the Chamber are ones dealing with trade with Czechoslovakia, Finland, China, Africa, East India and Russia. Since the beginning of the war the Customs and Regulations Department and the Statistics and Enquiries Department have been particularly busy.

Flameproof Apparatus

The customary quarterly list (shorter than usual) of mining and industrial apparatus for which certificates of flameproof enclosure were issued during the three months ended March, 1945, is available. A few copies can, at the request of B.E.A.M.A., be purchased for 1s. 2½d. each post free from the Library, Ministry of Fuel and Power, King's Buildings, Dean Stanley Street, Westminster, S.W.1.

Swedish C.W.S. and Lamp Prices

According to the Swedish International Press Bureau, the Swedish Co-operative Wholesale Society has requested the Swedish Government to try to reach an agreement with those countries which are manufacturing electric lamps on a large scale for the abolition of the customs duties on such lamps. If a free world market for electric lamps were created it would be practically impossible to maintain a monopolistic fixing of the prices, the Society contends. The Swedish Co-operative Society (K.F.) operates the Luma lamp factory in Stockholm, in which the Co-operative movements in the other Scandinavian countries are also financially interested. Immediately before the war a similar factory was started in Glasgow by the Scottish Co-operative Wholesale Society in collaboration with the Swedish K.F.

The "Davenset Diary"

The new house organ of Partridge, Wilson & Co., Ltd., the "Davenset Diary," is written largely by employees under the editorship of Mr. H. G. Wilson, managing director, with the firm's personnel manager (Mr. H. J. Lea) as the assistant editor. The first issue, dated January and containing 24 pages, outlines the firm's history from the commencement of its manufacturing activities in 1926 up to 1930, the present limited company having nine plants in operation employing over 500 people. In the second issue, dated April and enlarged to 32 pages, is an illustrated description of a journey by air to Greece and Egypt which Mr. Wilson with his camera and sample battery chargers undertook "In Search of Trade" twelve years ago.

Industrial X-ray Analysis

The X-ray Analysis Group of the Institute of Physics held its 1945 conference on April 12th and 13th at the Royal Institution, London. The conference was opened by Professor Sir Lawrence Bragg, O.B.E., F.R.S., the chairman of the Group. The first morning was devoted to a number of short contributions on new and improved methods, and in the afternoon there was a symposium on the equipment of X-ray laboratories, at which papers were read by Dr. R. F. Hanstock (High Duty Alloys, Ltd.), who dealt specially with equipment for determining residual stresses in metals; Mr. H. S. Peiser (Imperial Chemical Industries), who described a number of types of X-ray apparatus of wide applicability; and Dr. W. A. Wooster (Department of Mineralogy and Petrology, Cambridge University), who described chiefly the accessory crystallographic equipment that was necessary in addition to the X-ray apparatus.

In the evening Professor J. D. Bernal, F.R.S., spoke on the future of X-ray analysis.

The second day was devoted to a discussion on the application of optical principles to the interpretation of X-ray diffraction photographs.

Automatic Control of Machine Tools

At the April meeting of the Coventry Electric Club Mr. A. M. Craig read a paper on "Automatic Control Devices" and Mr. F. Godden, electrical engineer and manager, Coventry, presided. The paper reviewed the application of automatic controls in machine tools viewed from the points of view of the machine tool maker, the maintenance engineer and the control gear manufacturer. The need for the machine maker to provide sufficient space and proper wiring accommodation, and submit full technical information was stressed.

Standardisation of control components was suggested; the lecturer said that with 38 different parts, including minor items such as screws, nuts, etc., it was possible to assemble

any protective arrangement up to 40-A capacity. Various suggestions were made for the maintenance engineer with regard to points which should be observed in purchasing, especially with regard to contact design. In the discussion it was generally agreed that no suitable protection had yet been put on the market on an economical basis for use with fractional-HP motors which passed a current of less than half an ampere.

Power Station Extension Fees

Bolton General Purposes Committee has instructed the Mayor and the Town Clerk to submit the following resolution at the annual meeting of the Association of Municipal Corporations: "That in connection with the extensions to electricity generating stations owned by local authorities, this Association strongly disapproves of the policy of the C.E.B. which compels generating station officials either to engage consultants involving considerable expense or to pay large fees by way of grants for professional services to officials in the employment of local authorities."

Engineering Industry Wages

On Monday last the National Arbitration Tribunal heard a claim by the trade unions in the engineering industry for a substantial increase in basic rates. In earlier negotiations the Engineering Employers' Federation had rejected the claim on the ground that a general rise in wages would merely lead to increased cost of living. This would confer no benefit upon the workers but would prejudice our export position. It is expected that the Tribunal will announce its award in about a week's time.

Ballylumford Power Station

In connection with the description of Ballylumford power station, which appeared in our issue of April 13th, we are asked to state that the variable-speed AC motors installed for driving the forced-draught fans were made by Laurence, Scott & Electromotors, Ltd., and that the 3·3-kV two-speed motors driving the induced-draught fans were made by Lancashire Dynamo & Crypto, Ltd.

C.E.B. Report

Last year 99·03 per cent. of the electricity generated by authorised undertakings in Great Britain (excluding North Scotland) was produced at stations which were generating for the Central Electricity Board. The proportion, which was incorrectly stated in the account given of the Board's Report for 1944 on p. 561 of our issue of April 20th, is the highest yet recorded.

TRADE MARKS

APPLICATION has been made for the registration of the following trade mark. Objections can be entered within one month of April 18th:—

NICOPRESS.—No. 630,354, Class 9. Electric connectors for wires and cables.—National Telephone Supply Co., Cleveland, Ohio, U.S.A. Address for service: c/o Frank B. Dehn & Co., Kingsway House, 103, Kingsway, W.C.2.

Forthcoming Events

Saturday, April 28th.—*Barnsley.*—Queen's Hotel, 4 p.m. Association of Mining Electrical and Mechanical Engineers (Yorkshire North-West Branch). Annual general meeting.

Manchester.—Midland Hotel, 3 p.m. Institution of Factory Managers (N.W. Branch). "Training for Industrial Administration," by Dr. A. Roberts (Manchester College of Technology).

Huddersfield. — George Hotel, 2.30 p.m. I.E.E. North Midland Students' Section. Problems afternoon.

Monday, April 30th.—*Birmingham.*—James Watt Institute, 6 p.m. I.E.E. South Midlands Centre Radio Group. Annual general meeting and lecture on "High-frequency Dielectric Materials with special reference to Polythene," by Prof. Willis Jackson.

Tuesday, May 1st.—*London.*—Institution of Electrical Engineers, 7 p.m. London Students' Section. Discussion on the reports "Education and Training for Engineers" and "Part-time Further Education."

Manchester.—Engineers' Club, 6.30 p.m. I.E.E. North-Western Students' Section. Annual general meeting and problems evening.

Wednesday, May 2nd.—*London.*—Institution of Electrical Engineers, 5.30 p.m. Radio Section. "Notes on the Stability of L.C. Oscillators," by N. Lea.

Thursday, May 3rd.—*London.*—Institution of Electrical Engineers, 5.30 p.m. Installations Section. "Excess-current Protection by H.R.C. Fuses on Medium-voltage Circuits," by R. T. Lythall. "Excess-current Protection by Overcurrent Relays on Medium-voltage Circuits," by A. G. Shreeve and P. J. Shipton.

Friday, May 4th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. Measurements Section. "Meter and Instrument Jewels and Pivots," by G. F. Shotter.

London.—Royal Institution, 5 p.m. "Tidal Power," by Sir William Halcrow.

Saturday, May 5th.—*London.*—I.E.E. London Students' Section. Visit to Brimsdown power station (2.45 p.m.).

Monday, May 7th.—*Birmingham.*—James Watt Institute, 6 p.m. (tea 5.30 p.m.). Annual general meeting and visit of the President, Sir Harry Railing.

Tuesday, May 8th.—*Manchester.*—Engineers' Club, 6 p.m. I.E.E. North-Western Centre. Annual general meeting and paper, "The Place of Radiant, Dielectric and Eddy-current Heating in the Process Heating Field," by L. J. C. Connell, O. W. Humphreys and J. L. Rycroft.

Wednesday, May 9th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. "Localisation of Faults in Low-voltage Cables, with special reference to Factory Technique," by J. H. Savage.

London.—At Institution of Civil Engineers, 10.30 a.m. Iron and Steel Institute. Annual general meeting (continued on Thursday).

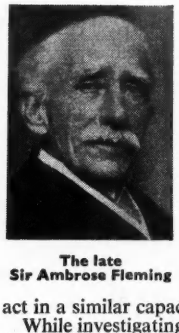
Thursday, May 10th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. Annual general meeting (corporate members and associates only).

Sir Ambrose Fleming

Fundamental Contribution to Broadcasting

BY the death on April 18th at the age of ninety-five of Sir Ambrose Fleming, Great Britain has lost one of the most illustrious of its long line of electrical engineers. Known throughout the world for his pioneer inventions in connection with the thermionic valve, on which wireless broadcasting is based, it is probably not so generally appreciated that these discoveries were the outcome of experience gained in work on the earliest electric lamps.

Sir Ambrose was associated in 1879 with the introduction into this country of the telephone and, as a result of his position as scientific adviser to the Edison interests in that connection, was retained to exhibit in London in the following year one of the first carbon-filament lamps. When Edison joined forces with Sir Joseph Swan to develop the lamp invented by the latter, Fleming continued to act in a similar capacity.



The late Sir Ambrose Fleming

While investigating the cause of the absence from the plane of the filament loop of blackening found elsewhere on the inside of these lamps, Edison had discovered that, on connecting a metal plate which he suspended inside a bulb to the positive terminal of a battery, an electric current passed, although the arrangement constituted an open circuit. On connecting it to the negative terminal, however, there was no flow of current. This result was described in 1883 and in that year Fleming published the result of his work in the same field which led to his conclusion that negative electricity could be given off from incandescent carbon and platinum filaments.

The nature of this negative electricity had to await Sir Joseph Thomson's discovery, in 1897, that the atom was composed of electrons, the quantity of which was shown by Richardson in 1903 to depend on the temperature of the emitting substance. Fleming it was, however, who saw that the principle could be used in rectifying high-frequency oscillations for detecting wireless signals. In 1904 he enclosed the filament in a metal cylinder—the essential feature of the " oscillation " or two-electrode thermionic valve—which was immediately adopted for the Marconi trans-atlantic receiving stations. He was the designer of the Marconi station at Poldhu, Cornwall.

His activities in other branches of electrical engineering embraced the design of measuring instruments, the reduction of transformer losses and advising on high-voltage power transmission, of which the Deptford (London) and the Niagara schemes were the most notable. He was the author of " Fifty Years of Electricity " (1921) and of text-books and papers on the subjects mentioned above and also on the electrical and magnetic properties of matter at low temperatures.

The early career of John Ambrose Fleming, who was born at Lancaster in 1849, was occupied in teaching. After being educated at University College, London, and the Royal College of Chemistry he worked for a time at South Kensington under Professor Guthrie and then as science master at Cheltenham College. He left Cheltenham in 1877 to study under Clerk Maxwell at the Cavendish Laboratory, Cambridge, subsequently becoming first professor of mathematics and physics at Nottingham University.

At thirty-six years of age Fleming was appointed Professor of Electrical Engineering at University College, London—a position from which he retired in 1926. Distinctions conferred upon him included the following:—The Hughes Medal of the Royal Society (of which he was made Fellow in 1892), the Albert Medal of the Royal Society of Arts, the Faraday Medal of the Institution of Electrical Engineers (1928) and the Duddell, Kelvin and Franklin Medals. He was knighted in 1929.

Clarence Gorge Scheme

DEVELOPMENT of the Clarence River Gorge as a source of hydro-electric power is surveyed by Sir Earle Page, C.H., in an illustrated brochure. He says that the Gorge, situated approximately 140 miles from Brisbane and 240 miles from Newcastle, offers an ideal site for the construction of a large dam. A 200 ft. high dam would impound 2,139,000 acre-ft. of water and about 75,000 kW could be generated comparatively cheaply. On the assumption that the cost of development is as high as £70 per kW of effective plant capacity; that the 165,000-V line and equipment linking the station with Brisbane would cost £500,000 (a very conservative estimate); and that the load factor of the output delivered to Brisbane would be 60 per cent. for a demand of, say, 50,000 kW, electricity could be delivered to Brisbane at an overall figure of 0·5d. per kWh. Sir Earle Page favours the setting up of a Clarence Valley Authority and a partnership arrangement between the Commonwealth, Queensland and New South Wales Governments.

E.A.W. Conference

Plans for the Association's 21st Birthday Celebrations

THE hope that after their wartime accomplishments and with their increased knowledge of electricity women would not recede from the position they had attained and would see that they obtained the electrical appliances they wanted in the home was expressed by Lord Brabazon of Tara, P.C., M.P., president of the British Electrical Development Association, at the annual conference of the Electrical Association for Women held at the Institution of Electrical Engineers, London, on Thursday last week (April 19th).

Tracing the course of our present knowledge of electricity, the corpuscular, neutron and Einstein theories, Lord Brabazon said that it was all born in the laboratory. Electricity was a branch of physics and Clerk Maxwell in expressing the work of Faraday in mathematical form had worked out all the rules of

Lord Brabazon addressing the conference. Miss C. Haslett (Director) and Lady Swaythling (President) are seen on the right of the speaker.

Several men were present to hear Lord Brabazon speak: Messrs. E. E. Hoadley, W. P. Lilwall and O. A. Sherrard

"radar" before it was even thought of. Owing to its pioneering work in the development of electricity this country had a number of different systems of supply and it was a considerable task to standardise on the 230-V, 50-cycle AC system. He was sure that the U.S.A., which had a 100-110 V, 60-cycle sytem, regretted not having a higher voltage. To-day the unit charge for electricity under the two-part tariff was under ¾d. in 83 per cent. of the houses connected, between ¾d. and 1d. in 14·8 per cent. and over that price in only 1·7 per cent.

Households could not be considered civilised these days unless they had electricity available. He hoped women would not wait for men to design apparatus, but would say what they wanted. He deplored the placing of power points close to the floor. Looking to the future, Lord Brabazon suggested the use of a moving staircase in the private house and foresaw developments in the use of short waves for cooking and pocket telephones. The production of a light-weight battery, already overdue, would revolutionise electric traction. The generation of electricity through atomic energy would provide electricity at lower cost and would provide the solution of the coal problem for our grandchildren. Another study was the relation of electricity to bio-chemistry.

At the annual general meeting of the E.A.W. which preceded Lord Brabazon's address, Miss Caroline Haslett, the director, gave some provisional details of the form of

Messrs. H. J. Randall, E. A. Mills and F. Newey

the twenty-first celebration of the Association's birthday in the autumn. It was hoped to complete the E.A.W.'s final report on post-war reconstruction and in October E.D.A. was planning to hold an exhibition at Dorland Hall portraying the development of electricity during the period in which the E.A.W. had been in existence, showing also what women had done during the war and giving a glimpse into future electrical developments.

The following officers were elected for 1945-46 : Lady Swaythling, president ; Lady Hurcomb, vice-president ; Mrs. Rendell-Baker, chairman ; Mrs. A. B. Lewis, vice-chairman ; and Alderman Mrs. Gregory, treasurer. In view of the extra work necessary in connection with the twenty-first birthday celebrations Mrs. A. B. Jackson and Miss F. E. Jones are to continue to serve as chairman and treasurer respectively until the autumn. In the election of members of the national executive committee Miss E. M. Parker (Bradford) replaces Mrs. F. W. Lawton (Sutton Coldfield). Lady Railing and Miss E. Denby have joined the council.

Plastics Federation

Speeches at Annual Luncheon

AT the annual luncheon of the British Plastics Federation held at the Savoy Hotel last week, the toast of " The Guests " was proposed by the chairman, MR. H. W. GRASSER-THOMAS (Yorkshire Tar Distilleries, Ltd.) who said that the year that had passed since the Federation's reconstitution had been one of opportunity and much encouragement, with exports becoming of real urgency. But they had felt hampered by the lack of any clearly defined post-war policy and a Government lead was eagerly awaited ; otherwise the plastics industry would be badly placed to meet competition from America, whose manpower and industrial resources had not suffered to the extent of Britain's and clearly intended to enter export markets which for so many years had been within the sphere of British influence. It was hoped that appeals for the retention and re-engagement of labour particularly well equipped to help export efforts would not fall on deaf ears and that priority would be given to machinery, without which the best workmen would be helpless.

Federation membership had increased during 1944 by 30 to 250 with eleven additions and twelve more applications this year. Not fewer than 50 committees were in active session and the " Hall Mark " scheme had been brought into being with the assistance of the British Standards Institution, which acted as the independent adjudicator. Licences had been granted to a number of manufacturers to apply the " Mark " to moulding powders, which were thereby guaranteed to comply with the relevant B.S.S., and it was now being considered how the " Mark " could best be applied to finished articles ultimately purchased by users. The " Mark " was registered by the B.S.I. with the Board of Trade.

MR. ERNEST BEVIN (Minister of Labour and National Service) responded with the remark that peasants still represented 76 per cent. of the world's population ; it would be necessary to raise their standard of life and development to urban level before mass purchase could be assured. Could there be order and discipline for " enough years " to win the war and secure Britain's leadership afterwards, so as to restore her position? Disturbance by the removal of controls must be avoided so as to prevent unbalancing industry, in view of the nation's export requirements. An endeavour was being made so to direct labour that every major and essential industry could be restarted. Let industry stand by those who were striving to re-establish industries in a national and orderly way, even those which returning workers would wish to avoid.

MR. L. P. B. MERRIAM (Plastics Controller) proposed the toast of the " British Plastics Federation " and expressed his gratitute for the support he had received from the industry which, without compulsion, had never refused to do things that were in the national interest or refrain from doing those which were not. The supply of raw materials had improved so much that it had become possible to release more of them, yet there was now said to be not enough labour for manufacturing requirements.

DR. W. J. WORBOYS (Imperial Chemical Industries, Ltd.) responded as vice-chairman of the Federation with an expression of the industry's lively appreciation of the value of Plastics Control and its administration. The complexity of tasks ahead was realised ; they must be approached with an expansionist philosophy, not restrictive, for speed was essential in such a highly competitive industry, especially in respect of export internationally.

MAJOR S. M. MOHR (Micanite & Insulators, Ltd.), immediate past-chairman, proposed a vote of thanks to the presiding chairman, with an intimation that he might be prevailed upon to accept a further term of office.

The annual general business meeting of the Federation followed the luncheon.

Electrical Moisture Meter

New Instrument for Making Rapid Tests

AN electrical moisture meter is discussed in a paper (a communication from the National Physical Laboratory) which DR. L. HARTSHORN and MR. W. WILSON submitted to the Measurements Section of the Institution of Electrical Engineers last Friday.

Following an outline of the purpose such instruments are intended to serve, with reference to various known types, the paper describes both the development and construction of a new meter that has already been put to good use in several industries.

The principle of operation is the application of a constant AC to a sample of the material to be tested, contained in a small vessel that may be regarded as a fixed air condenser, or in some instances as a conductive cell. The current passing through the sample is measured by a sensitive thermionic ammeter of special construction, which can be adjusted to indicate either the capacitance, proportional to the dielectric constant of the sample, or the conductance, proportional to its AC conductivity; alternatively some function of both the former values may be indicated. The current selected is that which shows the most favourable variation with moisture content.

The use of the new meter for testing seeds and grain, cattle foods, dried eggs and vegetables, flax, straw, fibre, tow, etc., is discussed and typical results are given while miscellaneous other applications are briefly referred to.

The instrument, both mains and battery models, has been devised for the Ministry of Supply and is put forward as a means to enable unskilled operators to make very rapid tests of the moisture contents of a great variety of non-metallic substances. But it is necessary to remember that natural substances are sometimes subject to variations that cannot be controlled. In fact the dielectric constant of water depends greatly upon the extent to which the molecules are free to rotate, as the authors explain. It seems highly probable that mechanical properties also will vary with differences of physical structure. It is thus quite possible that an electrical meter may be a better index than an oven test, for instance, of grain milling qualities.

Discussion

MR. W. E. DORAN (Cambridge Instrument Co., Ltd.), who opened the discussion, said his company made its moisture meter in 1923 and it was now making one on very similar lines to that described in the paper. However, pure capacity and pure resistance were not sufficient and an impedance bridge was made use of. The input to the circuit was from a radio-frequency oscillator driven by batteries. The instrument had proved very satisfactory with maize and tobacco, particularly, and had also been used with malt, flax seed, butter and tea. There was a great demand for this instrument and, although in many cases a high degree of accuracy was asked for, that was not essential and, indeed, it was difficult to get. There was no doubt a demand for an instrument to measure moisture to a high degree of accuracy and he thought the N.P.L. had gone a long way to meet it.

MR. ASHLEY JONES (J. Bibby & Son, and a member of the Society of Chemical Industry) spoke from the analytical point of view and said that his firm was the largest manufacturer of cattle food in this country. The need for a moisture meter in his case arose not only from the necessity to measure hundreds of samples of cattle food in its original state, but also a large number of commodities which went into the cattle food as compounded. Discrepancies had arisen between the meter and the oven readings and he asked for assistance in explaining them.

MR. S. BRIGHTWELL (Low Temperature Research Station) referred to the application of moisture meters to vegetables and said the authors' instrument had been found to work very satisfactorily. It was being operated by relatively unskilled people under factory conditions and an accuracy of $\pm 0{\cdot}5$ per cent. could be relied upon. A very high percentage of results was within $\pm 0{\cdot}2$ per cent.

MR. A. W. RUSSELL (Philips) said that he also had been concerned with the development of a moisture meter. The test condenser formed part of a tuned circuit together with a parallel variable capacity for zero adjustment. The tuned circuit was energised by a 1 Mc/s oscillator and the voltage across the tuned circuit was rectified by an infinite impedance detector with a 0-1 milliammeter in its anode circuit. The circuit was tuned to a frequency slightly higher than that of the oscillator so that the increase of capacity in the test condenser brought the circuit more nearly into resonance with the oscillator. The meter reading, and hence the sensitivity, was proportional to change of capacity and not directly to capacity, so that the moisture content of materials of higher dielectric constant could be accurately measured.

MR. R. F. S. HEARMAN (Forest Products Research Association) said that while the application of moisture meters to timbers had given satisfactory results, there were

certain limitations. There was the question whether the electrical recording of moisture in timber related only to the moisture in the surface cells or to the moisture throughout the whole of the timber. He had found that if there was a moisture gradient in the timber, the capacity type meter was probably less effective than the resistance type of instrument.

MR. P. M. BERNETT asked if the authors could give any indication of the behaviour of the instrument in relation to the pH value of the moisture, and also in relation to the temperature coefficient of the moisture.

MR. C. F. BROCKELSBY (Marconi Co.) said that the instrument now being made by his company was based on the same conclusions as the authors'. He asked if calibration changed with differing valve characteristics and he also suggested that there was an advantage in weighing a sample of grain instead of just filling the container, as the authors did. He had found a method of continuous recording which, applied to wheat, appeared promising.

MR. W. SCHIEK suggested that users of this type of instrument, when they desired to go into the refinements of moisture distribution in any substance, the amount of moisture and, perhaps, the chemical changes caused by water, should revert to some such method as the two ammeter test by which it was possible to check for capacitance and power factor and try to derive from the information so obtained some data which could be interpreted in everyday language.

MR. F. E. J. OCKENDEN pointed out that alteration in resistivity due to the soluble salts in the water had not been mentioned in the paper and as regarded the application of that type of meter to determining the moisture content of wood, he said the concentration of water would undoubtedly be higher in the heart of the wood. Therefore, it was necessary to try and get an estimate of the water content right through the wood. The point was whether two electrodes pushed into the wood would provide the information required.

DR. HARTSHORN, in his reply to the discussion, said that what the authors would like to know was how far certain factors varied with frequency. The pH value and soluble salts would affect the conductivity of wood and would therefore also affect the accuracy of any meter which depended mainly on conductivity. The authors had been mainly concerned with natural products and had assumed that their constitution would be more or less as determined by nature, but processing would affect the results and might be regarded by some people as an error of the moisture meter. However, it was usual in such cases to control the pH value more accurately than was necessary for the use of the moisture meter in the ordinary way. Weighing was the sort of operation one would avoid if possible.

North Wales Activities

Lieut.-Col. Rankin's Review

AT the quarterly meeting of the North Wales and South Cheshire J.E.A. on April 13th. Lieut.-Col. James Rankin, director and general manager of the North Wales Power Co. gave an account of the work of his company and the Electricity Distribution of North Wales & District, Ltd., during the war. The companies had constructed about 120 miles of h.v. and 18 miles of l.v. lines, and despite stringent conditions had been allowed to connect 3,192 new consumers, including 237 farms. They had received valuable assistance in this connection from the War Agricultural Executive Committees concerned. Col. Rankin mentioned the cumbrous procedure which had to be followed in connection with wayleaves which added to the delay caused by the difficulties in obtaining materials.

New works, mainly supplies to Government establishments, involved an expenditure of about £600,000; of this work only £50,000 worth was let out to contract, the bulk of it being carried out by their own construction staff. The maximum demand on the Power Company's system had risen from 38,900 kW at the end of 1939 to 87,950 kW at the end of 1943, an increase of 126 per cent. At the same time the system units had increased from 144 to 408 million—by 184 per cent. During the five years their hydro-electric stations had generated more than 420 million kWh, representing a saving of about 300,000 tons of coal. The additional requirements had been met without restriction largely on account of the foresight displayed in the layout of the main transmission system.

Although the Power Company had had to purchase three-quarters of the electricity consumed in North Wales at a price 114 per cent. above the 1938 level, there had been no increase in the published tariffs for domestic and other supplies. The company's report on the further development of hydro-electric resources in North Wales was primarily of a technical character; economic and other aspects would be discussed in due course with the Ministry of Fuel and Power and the Electricity Commissioners. Active consideration was being given by the companies to this and the schemes of development held in abeyance at the outbreak of war, some 150 in all, were being reconsidered with a view to their being put in hand as soon as the ban on general supplies was lifted.

Col. Rankin referred to the burden of local rates which had been stated to be a most serious obstacle to further development of water power resources. Provision had been made for the relief from rates of hydro-electric undertakings to be established in Scotland.

ELECTRICITY SUPPLY

Belfast Approves Proposals. Overhead Lines in Borrowdale.

Ashton-under-Lyne.—DISPOSAL OF PLANT.—The Town Council has discussed the disposal of the generating plant at the Wellington Road power station. The Electricity Committee gave one firm an option of three months for the purchase of the plant for £12,000, subject to the condition that they were able to dispose of the plant as a "going concern." Councillor Lewis T. Wright, chairman of the Electricity Committee, told the Council that it seemed to him unlikely they would get £12,000 for the plant, but the Council would be advised to sell it for scrap, if there was a possibility of getting a higher figure. When the option expired, the Committee would consider taking the line of inviting offers from two other firms.

Barrow-in-Furness.—LOANS.—The Electricity Committee is seeking sanction to borrow £3,500 for meters and £1,500 for apparatus.

Belfast.—PROPOSALS APPROVED.—A a meeting of Belfast Corporation on April 16th, approval was given to the proposals made by the representatives of the Ministry of Commerce and the Corporation Electricity Committee to set up a central electricity authority in Northern Ireland. There were two reservations; that the generating plant of Belfast should at all times be adequate to provide for the city's requirements, and that the Corporation should be consulted with regard to the appointment of the chairman and other members of the proposal authority. An amendment rejecting the scheme was defeated.

Mr. W. J. McC. Girvan, the city electrical engineer, submitted a report recommending that the proposals should be approved. If they were not put into effect, he stated, the development of electricity in the country would be retarded because of high production costs. In another report the consulting engineers to the Ministry of Commerce outlined a fifteen-year plan which provided for the development of the Ballylumford station, a hydro-electric station on the River Bann, and the Harbour power station. The assumption was made that before 1946 the East Bridge Street and Larne stations would have been shut down, and it was recommended that after the war the plant at these stations and at Londonderry should be dismantled and sold. The combined saving to Londonderry and the Board would, it was estimated, be £40,000 a year.

The report also dealt with the development of Ballylumford station to its full designed capacity. On the consultants' estimates it would be to the Corporation's advantage to the extent of £15,700 per annum to take supplies from the pooled output and the Ballylumford station should be developed prior to the Harbour power station. Commenting on the cost of coal to Ballylumford, which the consultants anticipated would be less than for coal delivered in Belfast (owing to the shorter sea route), Mr. Girvan said it should not be overlooked that a scheme (independent of the proposed power plant extensions) for improving the wharf facilities at the Harbour power station was before the Ministry of Commerce for approval. These proposed improved facilities would, it was believed, enable the Belfast station to obtain coal delivered into its bunkers at rates not less favourable than Ballylumford. If any difference in the cost of coal should obtain it would be due solely to the harbour dues payable at Belfast.

The general manager reaffirms his recommendation of December last that the plant extensions should be proceeded with on existing foundations at the Harbour station, the plant to be ready for service during the winter of 1946-47.

Burton-on-Trent.—LOANS.—The Electricity Committee is seeking sanction to borrow £85,150 for mains, substations and meters.

Cardiff.—NEW FEEDERS.—The Electricity Committee is to provide feeders from Heath estate to Fairoak kiosk (£2,550) and from Gabalfra substation to St. Michaels Road substation (£2,610) and increase the feeder from Great Western Lane substation to Gripoly Mills (£1,880).

SUPPLY TO HOUSING SITE.—The mains are to be extended to a housing site at Crystal Glen at a cost of £2,818.

Carlisle.—POWER STATION EXTENSIONS.—At a meeting of the City Council it was reported that the first extensions to the Willow Holme generating station had cost £501,036 for buildings and £670,474 for machinery. The previous loans sanctioned amounted to £1,075,000 and it was decided to apply for sanction to borrow the balance of expenditure amounting to £96,511. It was reported that the second scheme of extensions was well in hand.

Cockermouth.—ELECTRICITY IN BORROWDALE.—The question of overhead electricity lines in Borrowdale Valley, Lakeland, is again arousing controversy. Cockermouth Rural District Council, meeting last week, decided to support the Buttermere Green Slate Quarries Co., Ltd., in efforts to secure a grid electricity supply for its Borrowdale quarry and workmen's cottages. Mr. F. W. Walker said that in view of the movement to make Lakeland a national park it was important to preserve amenities and they should not give Borrowdale a supply of electricity in the cheapest and nastiest way. Mr. J. A. Cape said it was planned to use Borrowdale slate in the Council's post-war housing schemes, and it was the Council's duty to hasten the provision of an electricity supply in Borrowdale. Mr. G. Scott thought that the main consideration was that Borrowdale dwellers and industry needed electricity.

Hipperholme.—PURCHASE DATE POSTPONED.—The Electricity Commissioners have extended by a further three years the period after which the Brighouse Corporation (as successors of Hipperholme U.D.C.) may purchase the undertaking authorised by the Hipperholme Electric Lighting Orders, 1905 and 1907, from the Electrical Distribution of Yorkshire, Ltd.

Hull.—VICTORY DAY ILLUMINATIONS.—Replying to a question regarding V-day celebrations at a recent meeting of the Electricity Committee the general manager (Mr. D. Bellamy) stated that he had received certain instructions from the Special Celebrations Committee. The arrange-

ments included floodlighting of the Guildhall and the Queen's Gardens, fairy coloured lights in the Queen's Gardens where the fountain would operate, fairy lights in the centre of the city and the floodlighting of the Cenotaph.

DELAY IN ERECTION OF HOUSES.—When reference was made to the erection of temporary houses at Hopewell Road being behind schedule, Mr. Bellamy said that so far as the Electricity Department was concerned the cables were laid for every house and they were now only waiting for the houses in order to fit the meters.

Lichfield.—ELECTRICITY FOR FARMS.—The Electricity Committee is to provide a supply to Whittingdon Hurst Farm, Berry Hill Dairy, Ashmore Farm and Abnalls Farm.

Lowestoft.—LOANS.—The Electricity Committee is seeking sanction to borrow £30,000 for mains and services, substations and meters.

Matlock.—ELECTRIC STREET LIGHTING.—The Derbyshire and Notts Electric Power Co. is to convert the street lamps from gas to electricity for the Urban District Council.

Middlesbrough. — BULK SUPPLY. — The borough electrical engineer has been authorised to discuss the question of a bulk supply of electricity with the North-Eastern Electric Supply Co., Ltd.

Middleton.—POST-WAR DEVELOPMENT.—The Town Council has approved estimates of the acting borough electrical engineer for expenditure of £8,604 on schemes for necessary works in connection with post-war development.

Portland.—STREET LIGHTING SCHEME.—The Highways Committee has asked the surveyor to submit a scheme with costs, for electric street lighting of the type recently demonstrated.

Rochdale.—STREET LIGHTING POLICY.—The Town Council has decided that street lighting for the proposed Kirk Holt housing estate and any other new estate shall be by electricity.

Southend-on-Sea.—HIGHER CHARGES.—The Town Council has approved a recommendation of the Electricity Committee that charges shall be increased to meet the estimated loss of £45,235 on the undertaking for the ensuing financial year. The whole of the previous reserve fund and working balances have been utilised in recent years to meet deficiencies due to war conditions.

CONSUMERS' APPARATUS.—The town clerk is to communicate with the appropriate Government Department and also with the I.M.E.A. asking them to take all possible steps to urge the Government to make available to manufacturers material for consumers' apparatus for post-war development.

Stockton-on-Tees.—NEW SUBSTATIONS.—At its meeting last week the Electricity Committee considered a report on urgent work submitted by Mr. N. Hunter, who is shortly to take up the position of general manager and engineer. The Committee authorised the provision of five additional substations at West Row, Outram Street, Norton High Street, Albion Road estate and Hallifield Street. The cost of the work (buildings, switchgear, transformers, cables, etc.) is estimated at £44,700, which it is proposed to meet out of surplus revenue.

Stretford.—PREFABRICATED HOUSES.—Of the 160 prefabricated houses to be erected 102 are to be all-electric.

Wolverhampton.—SUPPLY TO HOUSING SITE.—The Electricity Committee is seeking sanction to a loan of £8,000 for providing a supply of electricity to temporary bungalows on the Willenhall housing site and £10,000 for prospective expenditure on mains and substation equipment.

York.—SUPPLY EXTENSION.—The Electricity Committee is seeking sanction to borrow £1,670 for extending the supply to Upper Poppleton.

Overseas

Sardinia.—PROGRESS OF HYDRO-ELECTRIC SCHEME.—According to a report by a correspondent of *The Times*, a rapid recovery is being made in the island, from which the Allied Administration was withdrawn last month. Public works which will, it is estimated, cost more than 73,000,000 lire are in hand or projected, and work on the Flumendosa hydro-electric scheme has reached an advanced stage. This 65,000-kW development is equal to half the present total capacity of the island's power plant.

I.E.E. Benevolence

THE annual report of the committee of management of the Benevolent Fund of the Institution of Electrical Engineers for 1944 shows that during that year applications for assistance were made on behalf of 80 persons, in assisting whom the fund also provided for the necessities of 63 dependants. The total amount of the grants made was £4,700, slightly less than in the previous year, the average amount granted to each beneficiary being £59. Some 9,662 contributions to the fund represented nearly 40 per cent. of the membership, which totalled 25,728; the average contribution per subscriber was 13s. 9d., but only 5s. 2d. for the whole membership. The fund received one legacy, 75 subscriptions and donations of over £5 each and 9,587 smaller ones, while dividends and interest raised the income to £9,139, an increase of over £1,000 on the previous year. A transfer of £2,000 from income as before raised the capital to £35,983, which is invested. There has been a gratifying increase of the number of contributors, now totalling 890, who subscribe under the arrangement whereby the fund is able to recover more than £880 of income tax.

Last year grants of £121 were made, to full members and their dependants only, from the Wilde trust fund, the invested capital of which stands at £3,050. One grant of £78 was made from the Lord Hirst fund, the invested capital of which is £11,531.

Royal Institution Lectures

TWO of the Royal Institution's "Friday Evening Discourses" next month are of electrical interest. On May 4th, Sir William Halcrow is to talk on "Tidal Power" and on May 11th Sir Lawrence Bragg will speak on "X-ray Analysis: Past, Present and Future." The lectures are at 5 o'clock (tea 4.30 p.m.) for members and their friends.

Cable Makers' Merger

Details of B.I.-Callender's Agreement

A MERGER of the main interests of two of the leading cable-making concerns was announced last week in a preliminary notice to stockholders of British Insulated Cables, Ltd., and Callender's Cable & Construction Co., Ltd., setting out provisional heads of agreement. Further details of the amalgamation proposals will be given when notices convening the necessary meetings are issued.

British Insulated Cables, Ltd., has an authorised capital of £4,000,000, of which £3,000,000 has been issued in the form of £500,000 of 6 per cent. cumulative preference stock, £500,000 of 5½ per cent. "A" cumulative preference stock, and £2,000,000 of ordinary stock. Callender's authorised capital is £2,300,000, of which £1,923,916 has been issued:—£400,000 of 6½ per cent. cumulative preference stock, £400,000 of 7½ per cent. "B" cumulative preference stock and £1,123,916 of ordinary stock. The last distribution on both companies' ordinary stock was 20 per cent.

Advantages of Amalgamation

The statement sent to stockholders says that for many years past the companies, while working in competition with one another, have co-operated in certain activities, particularly on the scientific improvement of their products and in methods of manufacture. Past experience of co-operation in these directions has convinced the directors of both companies of the substantial mutual advantages of a permanent amalgamation in successfully maintaining their trade in future years; in strengthening their position in relation to export trade; and in ensuring stability of employment for the Companies' workers after the war.

In view of this an independent committee of chartered accountants was set up to determine the relative values of the undertakings and acting upon this committee's recommendations it is proposed, subject to the stockholders' approval, to form a new company to acquire the two existing undertakings with the exception of Callender's Trust, Ltd. (the wholly-owned subsidiary of Callender's). The Trust, having interests not directly concerned with the businesses to be merged, will not be included in the amalgamation but will sell to the new company certain trade investments which it holds.

The issued share capital of the new company at its inception will total £11,219,175, made up as follows:—933,334 6 per cent. first cumulative preference shares of £1 each; 1,045,455 5½ per cent. second cumulative preference shares of £1 each; and 9,240,386 ordinary shares of £1 each, all fully paid. The formal consent of the Treasury to these issues has been obtained. The two existing companies will be wound up voluntarily and it is proposed that the new company's shares shall be allotted to the stockholders at the following rates:—

British Insulated Cables, Ltd.—One first cumulative preference share for each £1 of 6 per cent. cum. pref. stock in the present company; one 5½ per cent. second preference share for each £1 of 5½ per cent. "A" cum. pref. stock; and three ordinary shares for each £1 of ordinary stock.

Callender's Cable & Construction Co., Ltd.—Thirteen first cumulative preference shares in the new company for each £12 of 6½ per cent. cum. pref. stock in the present company; fifteen second cumulative preference shares for each £11 of 5½ per cent. "A" cum. pref. stock; and twenty-seven ordinary shares for each £10 of ordinary stock.

The new company will issue to Callender's Trust, Ltd., 205,812 ordinary shares as consideration for the acquisition of trade investments. The share capital of the Trust, consisting of 525,000 fully-paid £1 shares, will be distributed to the ordinary stockholders of Callender's Cable & Construction Co., in addition to the shares in the new company already mentioned.

Discharge-Lamp Circuits

TRENDS in the design and variations of circuits for discharge lamps were reviewed in a lecture delivered in London by Messrs. R. MAXTED and J. N. HULL (British Thomson-Houston Co.) before the Illuminating Engineering Society.

It was pointed out that such circuits must be compromises between perfection in physics and simplicity in use, installation requirements and performance considerations being likely to influence the choice of circuit to an increasing extent. Arc stabilisation requirements were examined as well as such wattage-controlling devices as are available, including various forms of inductance, capacitance and resistance ballast. Diversity was shown to be more apparent in the manner of initiating discharge, its effect upon the form of stabilisation being explained for both AC and DC circuits, while American practice was referred to.

Examination of the probability of performance variation indicated the need for maintaining relatively close tolerances in manufacture, even of the humble choke. The potential advantages of employing high-frequency power were mentioned and reference was made to the cyclic variation of light and to radio-interference suppression and noise.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The Oriental Telephone & Electric Co., Ltd.—In a statement circulated with the report and accounts (which were summarised in our last issue) the chairman, Sir A. Henry McMahon, refers to the Far East undertakings in which the company is interested. There is nothing fresh to say at the moment, but the directors continue to keep in touch with the Government Departments concerned with enemy-occupied territories and he hopes that when the next annual meeting is held he may have some more definite news to give. Last year he said that all the European members of the staff who were interned at Singapore had survived the hostilities there. He regrets, however, that since then news has been received that Mr. A. Buchanan, one of the senior engineers, has died in internment.

The North Somerset Electric Supply Co., Ltd.—The accounts for 1944 show a net revenue of £62,880 against £62,234 for 1943. To this is added interest and dividends from subsidiaries, £1,380 (£1,038) and £23,574 (£22,496) brought in. As already announced, a dividend of 7 per cent. is to be paid on the ordinary stock (same) and a balance of £6,434 is carried forward. Certain charges are made in the accounts; for instance, the net dividend proposed is charged in the net revenue account, which is the reason for the smaller carry forward. A consolidated balance sheet for the company and its subsidiaries (the Burnham & District Electric Supply Co., Ltd., and the Mid-Somerset Electric Supply Co., Ltd.) is also incorporated. The consolidated net revenue is £65,902 (against £65,181).

The Lancashire United Transport & Power Co., Ltd., held its annual meeting on April 13th. The chairman, Sir Arthur Stanley, said that to show the progress of the combined undertaking, including their subsidiary, the South Lancashire Transport Co., which operated 65 trolley-buses, it was interesting to compare 1944 with 1939. The total mileage operated in 1944 was 10,641,855 (against 9,292,522 in 1939); passengers carried were 91,261,491 (52,154,898); gross receipts were £926,331 (£502,590); and the number of buses and trolley-buses operated was 366 (265). Their ordinary regular services were, of course, reduced considerably owing to petrol restrictions.

Laurence, Scott & Electromotors, Ltd., is again paying 12½ per cent. on the "A" and "B" ordinary shares from a net profit of £110,032 (against £109,504).

The Superheater Co., Ltd.—The accounts for 1944 show a net profit of £128,031 (against £111,605 for 1943), this balance including £6,987 (nil) dividend from subsidiary, etc. The final ordinary dividend is increased from 25 to 27½ per cent., making 40 (against 37½) per cent. for the year, and £18,930 (£17,828) is carried forward.

The United River Plate Telephone Co. reports that gross earnings increased from £5,115,994 in 1943 to £5,398,273 last year, the net income improving from £1,028,703 to £1,098,708. The company is controlled by the International Telephone & Telegraph Corporation.

W. Canning & Co., Ltd., are paying a final ordinary dividend of 5 per cent., together with a bonus of 12½ per cent. The total distribution for the year is thus maintained at 22½ per cent.

The Southern Areas Electric Corporation, Ltd., is to pay a dividend of 5 per cent. (same) for 1944. The profits amounted to £27,667, as compared with £21,620 last year.

Murex, Ltd., has announced the usual interim dividend of 7½ per cent. on the ordinary stock.

Bullers, Ltd., have declared an interim ordinary dividend of 2½ per cent. (same).

New Companies

Newport's Electrics (Branksome), Ltd.—Private company. Registered April 5th. Capital, £750. Objects: To carry on the business of electrical engineers and repairers of electrical equipment, components or accessories, armatures and transformers. First directors: S. J. Newport, 117, Fernside Road, Poole (permanent managing director), and F. G. Marshall, 241a, Ashley Road, Parkstone. Secretary: A. H. Ayley. Registered office: 438, Poole Road, Branksome, Bournemouth, W.

E. Edwards & Co., Ltd.—Private company. Registered April 12th. Capital, £1,000. Objects: To carry on the business of registered electrical contractors, lighting, heating and general engineers, manufacturers of, and dealers in, electrical, motor and wireless requisites, etc. Directors: Grace Edwards, 132, Addison Road, Caternam, and V. Smonha, 45, Lebanon Court, Richmond Road, Twickenham. Registered office: 33, Leadenhall Market, E.C.3.

Arcright Radiant Heaters, Ltd.—Private company. Registered April 16th. Capital, £2,000. Objects: To carry on the business of manufacturers of, and dealers in, electric fires, heaters and lamps, horticultural and domestic heating appliances, etc. Directors: D. McLardy, D. McLardy, jun., and J. M. McLardy, all of 10, Woodview, Grays, Essex, and E. A. Stallworthy, 6, The Pines, Stifford Clays, Grays, Essex. Registered office: Dockside Works, Docks Road, Tilbury, Essex.

Electrical Power Installations (South Wales), Ltd.—Private company. Registered April 14th. Capital, £2,000. Objects: To carry on the business of electrical engineers, electrical installation contractors, wireless dealers, etc. Directors: A. R. Carter, 3, Caedelyn Road, Whitchurch, Glam., and T. Elder, Rosmarin, Windsor Avenue, Radyr, Cardiff. Registered office: 29, Park Place, Cardiff.

Croman (Instruments), Ltd.—Private company. Registered April 12th. Capital, £100. Objects: To carry on the business of manufacturers of, and dealers in, scientific instruments and machines, including graduated scales, dials and measuring instruments, radio, television and

X-ray equipment, electrical and mechanical clocks, etc. C. E. Holden is the first director. Registered office: 18-19, Market Hill Chambers, George Street, Luton.

M. & E. Services (Wholesale), Ltd.—Private company. Registered April 11th. Capital, £250. Objects: To carry on the business of electrical, mechanical and radio engineers, etc. First directors: T. A. Beavon, Effie E. Beavon and Georgina E. Holmes, all of Coed Derw, Chester Road, Wrexham, and Mrs. Marie I. Higginson, Oak Lodge, Marchweil, Wrexham. Registered office: 25, Holt Street, Wrexham.

Irish Domestic Electrical Appliances, Ltd.—Private company. Registered in Dublin April 5th. Capital, £2,500. Objects: To manufacture, import, export and deal in electrical appliances, goods and equipment of all kinds, etc. Subscribers: D. McK. Johnston and W. J. Adams, both of 34, South Frederick Street, Dublin.

Metropolitan Electrical Engineering Co., Ltd.—Private company. Registered in Dublin, April 6th. Capital, £3,000. Objects: To carry on the business of manufacturers of, and dealers in, dynamos, magnetos, electric motors, coils, condensers, batteries, etc. E. Keogh, 6, Greenville Terrace, South Circular Road, Dublin, is the first director.

Duplex Signs & Co., Ltd.—Private company. Registered April 3rd. Capital, £1,000. Objects: To carry on the business of manufacturers and erectors of electric, neon, daylight and other signs, etc. Directors: R. H. Webber, H. G. Webber and Maud M. Webber, all of Webley View, Cowick Lane, Exeter. Registered office: Webley View, Cowick Lane, Exeter.

Jones & Gilbert, Ltd.—Private company. Registered April 14th. Capital, £600. Objects: To acquire the business of an electrical contractor and radio merchant carried on by F. P. Jones at 163, Edgware Road, W.2. First directors: F. P. Jones, 163, Edgware Road, W.2, and O. C. Gilbert, 98, Spearing Road, Castlefield, High Wycombe, Bucks. Registered office: 163, Edgware Road, W.2.

Handwards & Co., Ltd.—Private company. Registered April 13th. Capital, £500. Objects: To carry on business as electricians, radio and electrical engineers, experts and contractors, metal and alloy makers, etc. Directors: H. W. Edwards, 32, Catesby Road, Rugby, and K. E. Handford and B. W. Handford, both of 124, Lawford Road, Rugby. Registered office: 153b, Lawford Road, New Bilton, Rugby.

Companies' Returns

Statements of Capital

John Richards & Co. (Electrical Engineers), Ltd.—Capital, £6,000 in £1 shares. Return dated November 18th, 1944. 4,802 shares taken up. £2 paid. £4,800 considered as paid. Mortgages and charges: Nil.

Premier Conduits, Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1944. 100 shares taken up. £100 paid. Mortgages and charges: Nil.

C. J. Ferguson & Sons, Ltd.—Capital, £5,000 in 2,500 cumulative preference and 2,500 ordinary shares of £1. Return dated November 30th, 1944. 2,500 preference and 1,802 ordinary shares taken up. £2,802 paid on 1,000 preference and 1,802 ordinary shares. £1,500 considered as paid on 1,500 preference shares. Mortgages and charges: Nil.

Yale Electric Power Co., Ltd.—Capital, £20,000 in £1 shares (16,700 ordinary and 3,300 preference). Return dated July 5th, 1944 (filed December 5th, 1944). 16,700 ordinary and 1,000 preference shares taken up. £16,000 paid. £1,700 considered as paid. Mortgages and charges: Nil.

Homefyre, Ltd.—Capital, £4,000 in 3,500 preference shares of £1, and 2,000 ordinary shares of 5s. Return dated January 12th, 1945. 1,600 preference and 2,000 ordinary shares taken up. £2,100 paid. Mortgages and charges: Nil.

Painter & Madew, Ltd.—Capital, £2,000 in £1 shares. Return dated October 2nd, 1944. 1,445 shares taken up. £1,085 paid. £360 considered as paid. Mortgages and charges: Nil.

Increases of Capital

Sturdy Electric Co., Ltd.—The nominal capital has been increased by the addition of £9,000 beyond the registered capital of £1,000 The additional capital is divided into 9,000 ordinary shares of £1 each.

New Light Fittings, Ltd.—The nominal capital has been increased by the addition of £1,800 in £1 ordinary shares beyond the registered capital of £2,000.

Heddesco, Ltd.—The nominal capital has been increased by the addition of £500 in 500 shares of £1, beyond the registered capital of £500.

Heddon-Smith & Co., Ltd.—The nominal capital has been increased by the addition of £500 in 500 shares of £1, beyond the registered capital of £500.

Liquidations

Chipping Norton Electric Supply Co., Ltd.—Particulars of claims to the liquidator, Mr. L. A. Pearl, 109, Jermyn Street, London, S.W.1, by May 25th.

Bankruptcies

K. G. Burfield, electrical contractor, Espere, Couchmore Avenue, Clayhill Avenue, Ilford, Essex.—The public examination was resumed recently at the Shire Hall, Chelmsford. Since the previous hearing debtor had prepared an amended statement of affairs. This disclosed liabilities of £425. Debtor was questioned regarding the disposal of certain furniture, and the Assistant Official Receiver said that the matter would need further investigation. The Registrar adjourned the proceedings for two months.

G. C. Pinney and **A. E. Miller,** wireless and electrical dealers, trading as "Granby Service Co.", 4, Granby Street, Littleport, Cambs.—Order made March 21st, granting discharge subject to a suspension of two months.

H. J. Gill, electrical engineer and radio dealer, 10, High Street, Keynsham, Somerset.—Supplemental dividend of 1s. 9d. payable April 27th at the Official Receiver's Office, 26, Baldwin Street, Bristol.

STOCKS AND SHARES

Tuesday Evening.

AS the war in Europe draws to its official close, markets in the Stock Exchange maintain their previous strength. In a good many cases, prices are better on the week. Cable & Wireless ordinary is still one of the firmest spots and has risen to within a point of par. Another feature is the spurt that has occurred in the ordinary shares of the British Insulated and Callender's Cable companies, the prices advancing sharply on news of the amalgamation. Home Railways remain out of favour as a result of political apprehensions. The "opening" of the Budget was not expected to affect Stock Exchange prices to any material extent.

The Month's Fluctuations

Electricity supply ordinary shares have gains ranging from 6d. to 2s. 3d., Midland Counties at 44s. 3d. securing the latter, while West Gloucestershire are 2s. up. London Associated Electricity rose 1s. 6d. to 28s. on the hope that the company will gradually raise its dividend to the pre-war 7 per cent. level. In the overseas group, Montreal Power, with a 2½ advance to 25½, and Perak Hydro-Electric, 1s. 6d. up at 14s. 6d., are notably good spots.

During the month, De la Rue shares have been as high as 11⅝, but the price reacted to 11¼, leaving it 2s. 6d. better on balance. Vactrics are an outstanding feature of strength with a rise to 24s. 9d. Amongst other improvements are Automatic Telephones at 68s. 6d., Ericsson Telephones at 56s. and Metal Industries "B" at 52s. 6d. A certain amount of irregularity characterises the trend of other price-fluctuations.

Cable & Wireless

The price of Cable & Wireless ordinary stock has gained 10½ during April, being now 99. Heavy and persistent buying followed circulation of the idea that overseas interests support the idea of the combine's being raised to the status of a semi-official board, corresponding in character to the Metropolitan Water, Central Electricity, and London Passenger Transport Boards. If this were to happen, the Cable & Wireless ordinary stock would acquire a more solid nature. By the same token, the 5½ per cent. preference might be replaced by a stock bearing a lower rate of interest. The price has therefore fallen 2½ to 114. Globe Telegraph ordinary rose 4s. to 45s. in sympathy with the advance in Cable & Wireless ordinary stock.

British Insulated and Callender's

Announcement of the merging of their main interests by the British Insulated Cables and Callender's Cable & Construction companies came as a surprise to the Stock Exchange market. Report had previously toyed with the idea that such a thing might possibly take place, but no importance was attached to the rumours, and official announcement of the companies' decision brought about immediate rises in the ordinary shares of the two companies. That the shareholders will agree to the proposals it is reasonable to expect. By the fusion of interests, the two companies place themselves in an extremely strong position as regards competition. The only wonder is that there should be no more than two companies engaged in the present arrangement. It is thought to be likely that this step will be the precursor of further amalgamations in the same branch of industry. Guesses are already being made by those who think they see prospects of a similar course of action being undertaken by other electrical and equipment companies.

Callender's Trust

The bulk of the shares of Callender's Trust, Ltd,, are held by Callender's Cable & Construction Company. The Trust Company's shares are to be distributed, under the present arrangement, to the ordinary stockholders of Callender's Cable & Construction. The price of the latter is 7s. 6d. up at 6¼. British Insulated are 4s. 3d. higher at £6.

Railways and Transport

The prior-charge stocks in the Home Railway group maintain their values with what seems to be a surprising amount of strength. Stocks such as Southern Railway 5 per cent. preference continue to be in constant request, in spite of the recent rises. The price is 6 points up since the end of March. While this absorption of trustee securities continues apace, the ordinary and deferred stocks of the main line companies move in the opposite direction. Public interest is reduced to a minimum, with the usual result that prices droop. Southern preferred eased off to 76½. London Passenger Transport "C" is a point lower at 65½, but the fixed interest issues of the L.P.T.B. are better. British Electric Traction deferred has risen 40, to 1215. Thomas Tilling shares are steady at 61s.

Telegraph Construction

Telegraph Construction shares are 1s. 6d. higher at 62s. 6d. ex dividend. The accounts for 1944 show that the total profits were £60,700 down as compared with the previous year, but the net profit of £50,710 is only £770 less than the 1943 figure. The year ends with December. After the ordinary shares had gone without a dividend for a year or

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ELECTRICAL INVESTMENTS

Past Month's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price April 24	Month's Rise or Fall	Yield £ s. d. p.c.
Home Electricity Ordinary					
Bournemouth and Poole	12½	12½	65/–	+1/-	3 17 0
British Power and Light	7	7	34/–	+6d.	4 2 4
City of London ..	5½	6	31/–	..	3 17 5
Clyde Valley ..	8	8	42/6	..	3 15 3
County of London	8	8	45/–	..	3 11 1
Edmundsons ..	6	6	32/–	..	3 15 0
Elec.Dis.Yorkshire	9	9	47/–	+6d.	3 16 8
Elec. Fin. and Securities ..	12½	13½	62/–	+6d.	4 7 1
Elec. Supply Corporation ..	10	10	51/6	+6d.	3 17 6
Lancs. Light and Power ..	7½	7½	38/–	..	3 19 0
Llanelly Elec. ..	6	6	30/–	+6d.	4 0 0
Lond.Assoc.Electric	3	4	28/–	+1/6	2 17 2
London Electric	6	6	31/–	..	3 17 5
Metropolitan E.S.	8	8	44/6	..	3 12 0
Midland Counties	8	8	44/3	+2/3	3 12 5
Mid. Elec. Power	9	9	45/–	..	4 0 0
Newcastle Elec.	7	7	32/6	..	4 6 2
North Eastern Elec.	7	7	36/–	+6d.	3 17 9
Northampton ..	10	10	51/6	+6d.	3 17 6
Northmet Power	7	7	43/–	+6d.	3 5 1
Richmond Elec.	6	6	26/6	..	4 10 7
Scottish Power ..	8	8	41/–	–6d.	3 18 0
Southern Areas	5	5	23/6	..	4 5 0
South London ..	7	7	30/–	..	4 13 4
West Devon ..	5	5	25/–	..	4 0 0
West Glos. ..	4½	3½	27/6	+2/-	2 11 0
Yorkshire Elec...	8	8	46/6	+1/–	3 8 9
Public Boards					
Central Electricity :					
1955–75 ..	5	5	115	..	4 7 0
1951–73 ..	4½	4½	107	..	4 4 0
1963–93 ..	3½	3½	105½	..	3 6 4
1974–94 ..	3½	3½	101	–1	3 3 9
LondonElec.Trans.	2½	2½	98½	..	2 10 9
London & Home Counties 1955–75	4½	4½	111	..	4 1 1
Lond.Pass.Trans.Bd.					
A	4½	4½	123½	+1	3 12 9
B	5	5	124½	+1	4 0 4
C	3½	3	65½	–1	4 11 7
West Midlands J.E.A. 1948–68	5	5	106½	..	4 14 0
Overseas Electricity Companies					
Atlas Elec. ..	Nil	Nil	7/6	+3d.	—
Calcutta Elec. ..	6*	6*	51/–	–6d.	2 7 0
Cawnpore Elec...	10	7	45/6	+3/-	3 1 6
East African Power	7	7	36/6	..	3 16 9
Jerusalem Elec...	7	5	28/–	..	3 11 5
Kalgoorlie (10/–)	5	5	10/–	–6d.	5 0 0
Madras Elec. ..	Nil	4	34/6	..	2 6 4
Montreal Power	1½	1½	25½	+2½	—
Nigerian Elec. ..	8	10	37/6	..	5 6 8
PalestineElec."A"	5*	5*	40/-	+6d.	2 10 0
Perak Hydro-elec.	6	7	14/6	+1/6	—
Tokyo Elec. 6%	6	6	25½	+2	—
VictoriaFallsPower	15	15	90/–	..	3 7 7
WhitehallInv.Pref.	—	6	26/–	..	4 12 4

Company	Dividend Previous	Dividend Last	Middle Price April 24	Month's Rise or Fall	Yield £ s. d. p.c.
Equipment and Manufacturing					
Aron. Elec. Ord.	10	15	62/–	..	4 16 9
Assoc. Brit. Eng.	6	7	53/9	..	2 12 0
Assoc. Elec. :					
Ord.	10	10	56/–	–2/3	3 11 6
Pref.	8	8	41/–	..	3 18 1
AutomaticTel.&El.	12½	12½	68/6	+⅛	3 13 0
Babcock & Wilcox	11	11	56/–	+2/6	3 18 7
British Aluminium	10	10	45/–	..	4 9 0
British Insul. Ord.	20	20	6	+4/3	3 6 8
British Thermostat (5/–)	18½	18½	20/9	..	4 9 0
British Vac. Cleaner (5/–)	30	30	33/–	..	4 11 0
Brush Ord. (5/–)	8	9	11/–	..	4 1 6
Burco (5/–) ..	15	15	16/–	+3d.	4 13 9
Callender's ..	15	20	6½	+7/6	3 4 0
ChlorideElec.Storage	15	15	90/–	..	3 6 8
Christy Bros. ..	12½	17½	77/6	..	4 10 2
Cole, E. K. (5/–)	15	20	41/3	..	2 6 0
Consolidated Signal	24	27½	6⅞	..	4 0 0
Cossor, A. C. (5/–)	7½*	10*	33/–	+6d.	1 10 4
Crabtree (10/–) ..	17½	17½	44/–	..	3 19 7
Crompton Parkinson Ord. (5/–) ..	20	22½	34/–	..	3 6 3
De La Rue ..	35	40	11½	+½	3 11 0
E.M.I. (10/–) ..	6	8	34/3	..	2 6 9
Elec. Construction	10	12½	62/–	..	4 0 8
Enfield Cable Ord.	12½	12½	61/6	–6d.	3 17 8
English Electric	10	10	56/–	..	3 11 5
Ericsson Tel. (5/–)	22*	20*	56/–	+1/6	1 15 9
Ever Ready (5/–)	40	40	45/–	..	4 9 0
Falk Stadelmann	7½	7½	36/3	..	4 2 9
Ferranti Pref. ..	7	7	34/6	+1/-	4 1 2
G.E.C. :					
Pref.	6½	6½	34/6	..	3 15 4
Ord.	17½	17½	96/6	–1/6	3 12 6
General Cable (5/–)	15	15	19/–	..	3 19 0
Greenwood&Batley	15	15	48/3	..	6 3 0
H.T.A. (10/–) ..	12½	12½	31/–	+1/-	4 0 8
Henley's (5/–) ..	20	20	29/3	+⅛	3 8 5
4½% Pref. ..	4½	4½	24/–	..	3 15 0
Hopkinsons ..	15	17½	80/–	..	4 7 6
India Rubber Pref.	5½	5½	24/–	..	4 11 9
Intl. Combustion	30	32½	7⅞	..	4 2 6
Johnson & Phillips	15	15	75/6	..	3 19 6
LancashireDynamo	22½	22½	105/–	..	4 5 10
Laurence,Scott(5/–)	12½	12½	14/–	+3d.	4 9 3
London Elec. Wire	7½	7½	39/–	..	3 17 0
Mather & Platt..	10	10	55/–	..	3 12 9
MetalIndustries(B)	8	8½	52/6	+2/–	3 5 0
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Mid. Elec. Mfg. ..	25	25	7⅛	..	3 8 1
Murex	20	20	5	–⅛	4 0 0
Newman Ind. (2/–)	20	20	8/–	+⅛	5 0 0
Philco (2/–)	—	—	14/6	–6d.	—
Power Securities	6	6	29/6	+6d.	4 1 4
Pye Deferred (5/–)	25	25	32/6	..	3 17 0
Ransome & Marles	20	20	92/6	+⅛	4 6 7
Revo (10/–) ..	17½	17½	43/6	..	4 0 5
Reyrolle ..	12½	12½	73/9	..	3 7 9

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price April 24	Month's Rise or Fall	Yield £ s. d.
Equipment and Manufacturing *(Continued)*					
Siemens Ord. ..	7½	7½	37/–	+6d.	4 1 1
Strand Elec. (5/–)	10	12½	10/9	–3d.	5 16 3
Switchgear & Cowans (5/–) ..	20	20	20/9	..	4 16 7
T.C.C. (10/–) ..	5	7½	26/–	..	2 17 9
T.C. & M. ..	10	10	62/6	+1/6	3 4 0
Telephone Mfg.(5/–)	9	9	12/–	..	3 15 0
Thorn Elec. (5/–)	20	20	29/–	..	3 9 0
Tube Investments	20	22½	5 5/6	..	3 19 10
Vactric (5/–) ..	Nil	22½	24/9	+3/9	4 12 0
Veritys (5/–) ..	7½	7½	8/6	–3d.	4 8 3
WalsallConduits(4/–)	55	55	53/6	+6d.	4 2 0
Ward & Goldstone (5/–)	20	20	30/6	..	3 5 8
WestinghouseBrake	14	14	78/9	..	3 11 1
West, Allen (5/–)	7½	7½	8/9	..	4 5 9
Traction and Transport					
Anglo-Arg. Trans. :					
First Pref. (£5)	Nil	Nil	2/6	..	—
4% Inc. ..	Nil	Nil	7	–½	—
Brit. Elec. Traction :					
Def. Ord. ..	45	45	1215	+40	3 14 0
Pref. Ord. ..	8	8	190	..	4 4 3
Bristol Trams ..	10	10	59/–	+2/–	3 7 9
Brazil Traction ..	1¾	2	26¾	–¼	7 9 6
Calcutta Trams..	6½	7½	61/6	–1/-	2 8 9
Cape Elec. Trams	5	6	25/–	–1/–	4 16 0
Lancs. Transport	10	10	49/–	+1/–	4 1 0
Southern Rly. :					
5% Prefd. ..	5	5	76½	–½	6 10 9
5% Pref. ..	5	5	123½	+6	4 1 0
T. Tilling ..	10	10	61/–	..	3 5 7
West Riding ..	10	10	48/6	+6d.	4 2 7
Telegraph and Telephone					
Anglo-Am. Tel. :					
Pref.	6	6	123½	–1	4 17 2
Def.	1½	1½	30½	+1	4 18 4
Anglo-Portuguese	8	8	28/–	+6d.	5 14 4
Cable & Wireless :					
5½% Pref. ..	5½	5½	114xd	–2½	4 16 6
Ord.	4	4	99	+10½	4 0 10
CanadianMarconi	$1 Nil	4cts.	11/6	–6d.	—
Globe Tel. & Tel. :					
Ord.	8¼*	5*	45/–	+4/–	2 4 6
Pref.	6	6	31/–	..	3 17 5
Great Northern Tel. (£10)	Nil	Nil	28	..	—
Inter. Tel. & Tel.	Nil	Nil	34	+2	—
Marconi-Marine..	7½	7½	35/6	..	4 4 6
Oriental Tel. Ord.	4	4	55/6	+4/–	—
Telephone Props.	Nil	6	20/6	+6d.	5 17 1
Tele. Rentals (5/–)	10	10	12/6	..	4 0 0

* Dividends are paid free of Income Tax.

Stocks and Shares

(*Continued from page* 626)

two, 7½ per cent. was paid for 1936. Since then, the annual dividend has been 10 per cent., with a capital bonus of 5 per cent. in 1939. The price of the shares went down at one time to 27s. 6d., and the present 62s. 6d. represents the highest figure reached for many years.

The Telegraph Construction & Maintenance Company goes back to 1864 ; it manufactures telegraph, electric lighting and power cables, etc., and carries on cable repair business. In addition, it owns a controlling interest in Selborne Plantations, Ltd., which has 3,600 acres in the F.M.S., also it holds shares in Telcon Cables, a South African company. The trading profits have risen with each successive year from 1935 to 1943 inclusive, and the reduction in profit for 1944 does nothing to weaken the financial stability of the company.

Indian Electricity

The news that the Cawnpore Electric Supply Corporation is to be acquired by the United Provinces Government, in 1947, has raised the price 3s. to 45s. 6d. The Indian Electricity Act of 1910 gave the Government of the United Provinces the necessary authority, and on July 8th, 1947, the undertaking will be acquired under the provisions laid down in the Act. The company was registered in 1905. Under the Act, the undertaking could be bought by the United Provinces Government at the end of 42 years or any subsequent ten-year period. No accounts have been published later than those for 1941. The dividend for last year was 7 per cent. Calcutta Electric Supply ordinary are easier at 51s. Delhi Electric Supply & Traction ordinary are quoted at 70s., and Madras ordinary at 34s. 6d. Calcutta Electric Tramways shares have gone back 1s. to 61s. 6d.

United River Plate Telephone

The United River Plate Telephone reports gross earnings in 1944 of £5,400,000, giving a net income of £70,000 higher than that for 1943. The year ends with December. From 1940 to 1943 inclusive, the annual dividend was 6 per cent. The company is controlled by the International Telephone & Telegraph Corporation. Its system, covering nearly 1¼ million miles of wire, operates in Buenos Aires and other Argentine cities. The 5½ per cent. redeemable preference shares are dealt in by the London market and stand at 21s. 6d. They are redeemable at 22s. by annual drawings up to December 31st, 1948, and at a guinea thereafter. The whole issue will be repaid by 1968. The capital of the company is £9¼ million, in addition to which there is £6,800,000 in debenture bonds. The ordinary shares are mostly held by the I.T.T. There is no Stock Exchange market in them.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

A. ABBEY (American Optical Co.).—"Fluorescent material." 11902. July 21st, 1943. (568445.)

Automotive Products Co., Ltd., and E. C. S. Clench.—"Relay action electric switches, more particularly for use in conjunction with fluid-pressure systems." 13735. August 23rd, 1943. (568427.)

C. A. Barron and H. D. Barron.—"Method of and means for feeding rods to wire-drawing machines." 18649. November 10th, 1943. (568486.)

H. A. Brassert & Co., Ltd., and R. Nissim.—"Electric arc furnace having a removable hearth or roof." 15640. September 23rd, 1943. (Addition to 542239.) (568451.)

British Thomson-Houston Co., Ltd.—"Electric protective devices." 14414/42. October 14th, 1941. (568383.) "Dynamo electric machines." 14919/42. October 25th, 1941. (568408.) "Permanent-magnet alloys." 11871/43. July 24th, 1942. (568418.) "Lamp changer for tubular electric lamps." 14697/43. September 9th, 1942. (568433.) "Automatic bread toasters." 14160/42. October 8th, 1941. (568498.)

British Thomson-Houston Co., Ltd., C. W. Wood and J. K. Frisby.—"Electric lighting fittings." 17877. October 29th, 1943. (568480.)

J. A. Crabtree & Co., Ltd., and R. W. Morgan.—"Electric tumbler switches." Cognate applications 15367/43, and 21204/43. September 18th, 1943. (568435.)

Electroflo Meters Co., Ltd., and W. R. Goff.—"Automatic variation of a condition such as temperature." 12972. August 11th, 1943. (568424.)

B. Erber.—"Electronic valves." 5053. March 29th, 1943. (568411.) "Electronic valves." 22073/44. March 29th, 1943. (Divided out of 568411.) (568437.)

Ferranti, Ltd., R. G. B. Gwyer and J. G. Heaps.—"Transmission lines for ultra high radio frequencies." 7968. May 3rd, 1940. (568378.)

C. H. Flurscheim, H. Holmes and Metropolitan-Vickers Electrical Co., Ltd.—"Electric circuit interrupters." 14224. August 31st, 1943. (568429.)

General Electric Co., Ltd., and D. C. Espley.—"Switches for high-frequency electric oscillations." 14816. November 18th, 1941. (568379.)

General Electric Co., Ltd., and R. W. G. Field.—"Systems for the remote indication of meter readings." 19617. November 24th, 1943. (568495.)

General Electric Co., Ltd., and J. H. Partridge.—"Glass of low thermal expansion." 10775. July 2nd, 1943. (568469.)

H. Gibbs.—"Electric inspection lamp." 21286. December 19th, 1943. (568407.)

Hoover, Ltd.—"Dynamo-electric machines." 8969/43. June 8th, 1942. (568395.)

Hoover, Ltd., and A. W. White.—"Commutators for dynamo-electric machines." 16100. October 1st, 1943. (568472.)

Landis & Gyr Soc. Anon.—"Frequency relays." 4935/43. March 26th, 1942. (568390.) "Remote control installations." 3952/43. March 16th, 1942. (568410.)

Langley Alloys, Ltd., and H. M. Malies.—"Electrolytic polishing." 16228. October 4th, 1943. (568454.)

Marconi's Wireless Telegraph Co., Ltd.—"Variable inductance devices and variable permeability tuning arrangements." 16040/43. September 30th, 1942. (568436.) "Electromagnetic inductive devices having split cores." 16173/43. October 2nd, 1942. (568473.)

Mullard Radio Valve Co., Ltd., and A. J. H. Van Der Ven.—"Voltage stabilising circuits." 11956. July 22nd, 1943. (568446.)

Nalder Bros. & Thompson, Ltd., and C. L. Lipman.—"Electrical instruments and relays." 16962. October 15th, 1943. (568461.)

Philips Lamps, Ltd., A. C. Van Den Berg, and H. Kenyon.—"Abrasive drilling machines." 16008. September 29th, 1943. (568524.) "Drilling machines." 22672/44. September 29th, 1943. (Divided out of 568524.) (568527.)

Sangamo Weston, Ltd.—"Instrument type electrical relays." 16773/43. December 4th, 1942. (568457.)

Self-Changing Gear Co., Ltd., A. G. Wilson and A. A. Miller.—"Electromagnetic clutches or brakes." 1669/43. March 1st, 1944. (568409.)

Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington.—"Hermetic sealing of metal into vitreous material." 15319. September 17th, 1943. (568448.)

Standard Telephones & Cables, Ltd.—"Electric battery charging system." 14412/43. December 5th, 1942. (568430.)

Standard Telephones & Cables, Ltd., and C. H. Chambers.—"Electric signalling systems." 15893. September 28th, 1943. (568400.)

Standard Telephones & Cables, Ltd., and W. R. Moscrip.—"Manufacture of electric vacuum tubes." 15689. September 24th, 1943. (568452.)

Standard Telephones & Cables, Ltd. (International Standard Electric Corporation).—"Control of selectors such as used in automatic telephony." 17423. October 22nd, 1943. (568476.)

W. Stern.—"Electric flat-irons." 9044. June 5th, 1943. (568396.)

B. Tenenbaum.—"Piezo-electric crystals." 17949/42. August 31st, 1943. (568468.)

Waite & Son, Ltd., and H. C. Waite.—"Lamp shades and their method of manufacture." 20865. December 13th, 1943. (568406.)

Watford Electric & Manufacturing Co., Ltd., and B. A. Vuille.—"Escapement mechanisms." 12758. August 6th, 1943. (568423.)

Westinghouse Electric International Co.—"Oscillation generator apparatus for induction heating." 17294/43. November 5th, 1942. (568463.)

Amended Specification

533251. Allmänna Svenska Elektriska Aktiebolaget.—"Dry rectifiers mounted in cubicles."

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—July 4th. Victoria State Electricity Commission. 40,000-kVA synchronous condenser, Spec. 44-46/1.

July 11th. New South Wales Railways. Traction motors, control equipment, air compressors and pantographs for one electric locomotive.

Batley.—April 30th. Town Council. Cables. (April 20th.)

Birkenhead.—May 14th. Electricity Department. Cables, meters and general stores. (See this issue.)

Bury. — May 7th. Electricity Department. Meters and p.i. cables. (April 20th.)

Glasgow.—April 30th. Corporation. Supply and erection of electrically-driven centrifugal pumps. Manager, Sewage Department, 50, John Street, Glasgow, C.1.

Grimsby.—May 1st. Electricity Department. Switchgear, transformers and cables. (April 20th.)

Long Eaton.—May 12th. Electricity Department. H.v. switchgear. (See this issue.)

Louth.—May 11th. Electricity Department. Cables, transformers and switchgear. (April 20th.)

Manchester.—April 30th. Electricity Department. Extensions to 33,000-V switchgear at the Barton generating station and Benchill substation. (April 13th.)

Plymouth. — May 5th. Electricity Supply Department. L.v. underground network disconnecting boxes. (April 13th.)

Orders Placed

Bradford.—Electricity Committee. Accepted. Steam and feed piping for Nos. 9 and 10 boilers. Babcock and Wilcox. Auxiliary switchgear for Nos. 9 and 10 boilers.—Brookhirst Switchgear. One surge tank and two water storage tanks.—Newton Chambers and Co.

Buildings Committee. Accepted. Electric goods lift at Colliergate (£575).—F. Ellison & Co.

Cardiff.—Electricity Committee. Contracts extended for twelve months. Cables.—Aberdare Cables. Switchgear.—G.E.C.; and Ferguson Pailin.

Eccles.—Electricity Committee. Accepted. Two 500-kVA transformers at Chatsworth Road and Philip Street substations.—Metropolitan-Vickers.

Glasgow. — Municipal Transport Committee. Accepted. Asbestos covered wire.—London Electric Wire Co. & Smiths.

Manchester. — Electricity Committee. Accepted. High-voltage switchgear. — Ferguson, Pailin. Modifications to fire-extinguishing equipment.—Mather & Platt.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Blackley.—Research laboratory and works alterations; Russell Building & Contracting Co., Ltd., 165, Plymouth Grove, Manchester, 13.

Blackpool.—Boiler house, Whitegate Drive; Johnson & Starley, Ltd.

Bolton.—Secondary school, Halliwell, for Catholic authorities; Rev. Dr. Bernard Slaven, R.D.

Brighouse.—Works additions, Sunny Bank Road; A. H. Leach & Co., Ltd., photo enlargers, Halifax Road.

Bury.—Extensions to the Infirmary; secretary to the governors.

Grantham.—Works and offices, Dysart Road; Grantham Boiler & Crank Co., Ltd.

Kettering.—Maternity ward at General Hospital; borough surveyor.

Liverpool.—Canteen and dining hall at Hunts Cross Council School, Kingsthorne; L. H. Keay, city architect, Blackburn Chambers, Dale Street.

Newcastle-on-Tyne.—Extensions to factory of Harding & Co.; Curry Bros., Meldon Street.

Extensions to premises of I. A. Hodgson & Co., Ltd.; Alex. Anderson (Contractors), Ltd., Stanmore Road.

Newton Heath.—Additions to foundry and works extensions; J. Gerrard & Sons, Ltd., builders, Swinton.

Oban (Argyll).—Completion of St. Columba's Roman Catholic Cathedral of Argyll and the Isles and new Bishop's residence; The Bishop, Oban.

Openshaw.—Works extensions, Victoria Street; Brierley & Thompson, Ltd., builders, Union Saw Mills, Boundary Street, Bury.

Rotherham.—Special schools for mentally handicapped children (£15,000); V. Turner, borough surveyor.

Co-operative dairy; Secretary, Rotherham Co-operative Society, Main Street.

Shropshire.—Scheme for technical college hostel at Shrewsbury; county architect, 5, Belmont, Shrewsbury.

Stirling.—Proposed municipal crematorium; burgh surveyor.

Stockport.—Central school kitchen; W. E. Gardner, borough surveyor.

Tamworth.—Extensions of hospital buildings; Major A. E. de Hamel, chairman, Board of Management.

Swinton.—Extensions to Albert Mills; D. Barker & Sons, Ltd., contractors, Saw Mills, Chorley Road, Swinton.

Warrington.—Milk depot (£20,000); secretary, Warrington & District Dairymen's Wartime Association.